

## **Martins Manufacturing Inc.: An advanced ABC/ABM case, with strategic considerations**

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### **ABSTRACT**

A hypothetical manufacturing scenario is introduced in this case which focuses on costing system design in which the firm's costing system evolves from a simple Volume-Based-Costing (VBC) system to an Activity-Based-Costing (ABC) system involving multiple stage allocations. System design is viewed from both a costing perspective (ABC) and a managerial perspective (ABM). GAAP compliance is addressed along with strategic consequences.

Keywords: Product Costing, Activity-Based-Costing, Volume-Based-Costing, Activity-Based-Management, Absorption Costing, Strategic Costing.

### **Targeted Students**

This case addresses several costing issues and can serve as a comprehensive product costing case for intermediate level students. The most appropriate course for this case would be an intermediate Cost and/or Managerial Accounting course. This case could also be utilized in an MBA or Masters of Accounting Managerial Accounting course.

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## INTRODUCTION

For many years, Martins Manufacturing Inc. (MMI) manufactured a single product (P-A) which involved two manufacturing departments, Department 1 and Department 2. P-A competes in a very competitive market, which places a great deal of pressure on its margins. Due to the success of P-A, last year in 2010, the company increased production capacity by automating Department 2 and introduced a second, more complex product (P-B) which because of its distinctive characteristics would be able to earn much better margins than P-A. Prior to the introduction of P-B, there was no formal allocation of indirect manufacturing costs since all production costs were absorbed by the production of P-A. In 2010 MMI began to allocate manufacturing overhead (MOH) using an actual plant-wide overhead allocation rate using direct labor hours (DLHs).

MMI had expected to produce and sell 40,000 units of P-A and 10,000 units of P-B in 2010. However, actual production and sales of P-A were only 20,000 and were also 20,000 for P-B. Sales prices for P-A and P-B are set by marking up their calculated costs. Due to the highly competitive market P-A competes in, MMI uses a 10% markup while P-B, due to its distinctive characteristics, is marked up 30%. Assume no changes over time in input prices or productivity.

Actual cost information for 2010 is presented in Table 1 (Appendix).

### PART A

Required:

1. Determine the actual plant-wide MOH allocation rate utilizing DLHs.
2. Determine the manufacturing costs per unit for P-A and P-B.
3. Prices for P-A and P-B were marked up from calculated production costs based on the actual sales mix. Determine the calculated sales prices for P-A and P-B.
4. Determine the per unit gross profit for P-A and P-B.

### PART B

Despite the popularity of the new P-B, company profits have declined steadily since Department 2 was automated. Management is beginning to think that there may be a problem with the costing system. Consequently, in 2011 management has decided to improve their cost accounting system by moving from the use of the actual plant-wide overhead rate to a normal or predetermined plant-wide overhead rate. Budgeted information for 2011 is presented in Table 3 (Appendix).

Required:

5. Determine the normal plant-wide MOH allocation rate utilizing DLHs.
6. Determine the manufacturing costs per unit for P-A and P-B.
7. Determine any amount of under/over applied MOH.
8. Prices for P-A and P-B were marked up from calculated production costs based on the budgeted sales mix. Determine the calculated sales prices for P-A and P-B.
9. Determine the per unit gross profit for P-A and P-B.

10. Comment on any differences in calculated product costs and gross margins to products P-A and P-B due to using an actual plant-wide MOH allocation rate vs. a normal plant-wide MOH allocation rate.

### **PART C**

As profits continue to decline management decides to further improve their cost accounting system by moving from the use of the one normal plant-wide overhead rate to two normal departmental overhead rates for 2012. Since Department 1 is labor intensive, MOH will be allocated to job orders on the basis of direct labor hours (DLHs). Since Department 2 is capital intensive, MOH will be allocated to job orders on the basis of machine hours (MHs).

Management also differentiates between the two operating departments and the support costs related to occupancy, purchase orders and energy costs. In this stage one allocation, these costs will be allocated to the two operating departments and then those departmental costs will be allocated in a stage two allocation to products P-A and P-B. There is some debate within MMI about whether the direct or step-down method should be used.

Required:

11. Allocate support costs to the two operating departments using the direct method.
12. Determine the normal departmental MOH allocation rates.
13. Determine the manufacturing costs per unit for P-A and P-B.
14. Determine any amount of under/over applied MOH.
15. Determine the per unit gross profit for P-A and P-B using the sales prices from #3.
16. Determine the per unit gross profit for P-A and P-B using the sales prices from #8.
17. Allocate support costs to the two operating departments using the step-down method.
18. Determine the normal departmental MOH allocation rates.
19. Determine the manufacturing costs per unit for P-A and P-B.
20. Determine any amount of under/over applied MOH.
21. Determine the per unit gross profit for P-A and P-B using the sales prices from #3.
22. Determine the per unit gross profit for P-A and P-B using the sales prices from #8.
23. Comment on any differences in calculated product costs and gross margins to products P-A and P-B due to using the direct allocation method vs. the step-down allocation method and with respect to using the single plant-wide MOH rate versus the two departmental MOH rates.

### **PART D**

As of 2013 profits are still suffering and the new chief accountant, Daniel Michaels advocates utilizing an Activity-Based-Costing (ABC) system. Michaels determines that there are three resource pools and twelve activity pools. The first and second stage allocations are specified in Table 2 (Appendix).

Required:

24. Determine the normal activity allocation rates.
25. Determine the manufacturing costs per unit for P-A and P-B.
26. Determine any amount of under/over applied MOH.

27. Determine the per unit gross profit for P-A and P-B using the sales prices from #3.
28. Determine the per unit gross profit for P-A and P-B using the sales prices from #8.
29. Comment on any differences in calculated product costs and gross margins to products P-A and P-B due to using the ABC model versus the VBC departmental model.

## **PART E**

The adaption of the ABC system provides significant insights into resource consumption but also significantly increases the “cost” of operating the costing system as a result of increased information demands. Can the ABC system be streamlined to provide the same level of accuracy in costing products but reducing the “cost” of operating the system? Setup and inspection activities exclusively utilize indirect labor.

Required:

30. Streamline/redesign the ABC system.
31. Determine the normal activity allocation rates.
32. Determine the manufacturing costs per unit for P-A and P-B.
33. Determine any amount of under/over applied MOH.
34. Determine the per unit gross profit for P-A and P-B using the sales prices from #3.
35. Determine the per unit gross profit for P-A and P-B using the sales prices from #8.
36. Comment on any differences in calculated product costs and gross margins to products P-A and P-B due to using the original ABC system with the streamlined ABC system. Under what scenarios would each system be most appropriate?
37. All the costing systems developed have been designed to comply with GAAP. If MMI were to relax this constraint, in what way might the ABC system be modified?
38. Compare the GAAP based and non-GAAP based ABC systems, and comment on any differences.

## **PART F**

Required:

39. Comment on the potential strategic consequences for P-A and P-B resulting from the use of an inaccurate product costing system.

## APPENDIX

TABLE 1: ACTUAL

| Cost Component                     | P-A           | P-B           | Both           | Cost           |
|------------------------------------|---------------|---------------|----------------|----------------|
| <b>Actual Production and Sales</b> | <b>20,000</b> | <b>20,000</b> | <b>40,000</b>  |                |
| <b>Direct Material (DM) used</b>   |               |               |                |                |
| DM-X (lbs)                         | 80,000        | 80,000        | 160,000        | \$1,080,000.00 |
| DM-Y (lbs)                         | 0             | 200,000       | 200,000        | \$2,250,000.00 |
| <b>DL used:</b>                    |               |               |                |                |
| <b>Operating Department 1 (D1)</b> |               |               |                |                |
| Direct Labor (DLHs)                | 50,000        | 6,000         | 56,000         | \$672,000.00   |
| Indirect Labor (IDLHs)*            | 10,000        | 20,000        | 30,000         | \$450,000.00   |
| <b>Operating Department 2 (D2)</b> |               |               |                |                |
| Direct Labor (DLHs)                | 10,000        | 12,000        | 22,000         | \$396,000.00   |
| Indirect Labor (IDLHs)*            | 2,000         | 8,000         | 10,000         | \$200,000.00   |
| <b>Machine Hours (MH) used:</b>    |               |               |                |                |
| Department 1 (MHs)                 | 10,000        | 20,000        | 30,000         | \$750,000.00   |
| Department 2 (MHs)                 | 10,000        | 40,000        | 50,000         | \$1,700,000.00 |
| <b>Setups</b>                      |               |               |                |                |
| Department 1 (Setups)              | 8             | 8             | 16             | \$12,000.00    |
| Department 2 (Setups)              | 10            | 10            | 20             | \$32,000.00    |
| <b>Inspections</b>                 |               |               |                |                |
| Department 1 (Inspections)         | 200           | 200           | 400            | \$150,000.00   |
| Department 2 (Inspections)         | 400           | 400           | 800            | \$400,000.00   |
| <b>Power used (kilowatts):</b>     |               |               |                | \$683,200.00   |
| Department 1 (kHw)                 |               |               | 1,200,000      |                |
| Department 2 (kHw)                 |               |               | 11,000,000     |                |
| Total kWhs:                        |               |               | 12,200,000     |                |
| <b>Purchase Orders:</b>            | <b>DM-X</b>   | <b>DM-Y</b>   |                |                |
| Number of Purchase Orders          | 320           | 1,000         | 1,320          |                |
| DM-X                               |               |               |                | \$57,600.00    |
| DM-Y                               |               |               |                | \$220,000.00   |
| <b>Building Occupancy</b>          |               |               |                | \$1,570,000.00 |
| Depreciation                       |               |               | \$1,500,000.00 |                |
| Property Taxes                     |               |               | \$40,000.00    |                |

|                                     |         |                        |
|-------------------------------------|---------|------------------------|
| Insurance                           |         | \$30,000.00            |
|                                     |         | <u>\$1,570,000.00</u>  |
| <b>Square feet occupied: sq ft:</b> | 550,000 |                        |
| Purchasing                          |         | 20,000                 |
| Power                               |         | 30,000                 |
| Department 1                        |         | 200,000                |
| Department 2                        |         | <u>300,000</u>         |
|                                     |         | <u>550,000</u>         |
|                                     |         | <u>\$10,622,800.00</u> |

\* IDLHs are used to operate machinery, and perform setups and inspections

**TABLE 2: STAGE ONE AND STAGE TWO ALLOCATIONS**

| <b>Stage One Allocations to Intermediate Cost Objects</b> |                    |                                 |
|---|--------------------|---------------------------------|
| <b>Resource Pool</b>                                      | <b>Cost Object</b> | <b>Resource Allocation Base</b> |
| Occupancy   | Departments        | Square feet occupied            |
| Energy  | Departments        | Kilowatt hour                   |
| Purchasing  | Materials          | Purchase Orders                 |

  

| <b>Stage Two Allocation to Final Cost Objects</b> |                    |                                 |
|---|--------------------|---------------------------------|
| <b>Activity Pool</b>                              | <b>Cost Object</b> | <b>Activity Allocation Base</b> |
| Indirect Labor – department 1                     | Products           | Indirect Labor Hours (IDLHs)    |
| Indirect Labor – department 2                     | Products           | Indirect Labor Hours (IDLHs)    |
| Inspections – department 1                        | Products           | Inspections                     |
| Inspections – department 1                        | Products           | Inspections                     |
| Setups – department 1                             | Products           | Setups                          |
| Setups – department 1                             | Products           | Setups                          |
| Energy – department 1                             | Products           | Machine Hours (MHs)             |
| Energy – department 2                             | Products           | Machine Hours (MHs)             |
| Machine Related – department 1                    | Products           | Machine Hours (MHs)             |
| Machine Related – department 1                    | Products           | Machine Hours (MHs)             |
| Occupancy – department 1                          | Products           | Machine Hours (MHs)             |
| Occupancy – department 2                          | Products           | Machine Hours (MHs)             |

**TABLE 3: BUDGETED**

| <b>Cost Component</b>                | <b>P-A</b>    | <b>P-B</b>    | <b>Both</b>   | <b>Cost</b>    |
|--------------------------------------|---------------|---------------|---------------|----------------|
| <b>Budgeted Production and Sales</b> | <b>40,000</b> | <b>10,000</b> | <b>50,000</b> |                |
| <b>Direct Material (DM)</b>          |               |               |               |                |
| DM-X (lbs)                           | 160,000       | 40,000        | 200,000       | \$1,350,000.00 |
| DM-Y (lbs)                           | 0             | 100,000       | 100,000       | \$1,125,000.00 |
| <b>Operating Department 1 (D1)</b>   |               |               |               |                |
| Direct Labor (DLHs)                  | 100,000       | 3,000         | 103,000       | \$1,236,000.00 |

|                                     |             |             |                |                       |
|-------------------------------------|-------------|-------------|----------------|-----------------------|
| Indirect Labor (IDLHs)*             | 20,000      | 10,000      | 30,000         | \$450,000.00          |
| <b>Operating Department 2 (D2)</b>  |             |             |                |                       |
| Direct Labor (DLHs)                 | 20,000      | 6,000       | 26,000         | \$468,000.00          |
| Indirect Labor (IDLHs)*             | 4,000       | 4,000       | 8,000          | \$160,000.00          |
| <b>Machine Costs</b>                |             |             |                |                       |
| Department 1 (MHs)                  | 20,000      | 10,000      | 30,000         | \$750,000.00          |
| Department 2 (MHs)                  | 20,000      | 20,000      | 40,000         | \$1,360,000.00        |
| <b>Setups</b>                       |             |             |                |                       |
| Department 1 (Setups)               | 16          | 4           | 20             | \$15,000.00           |
| Department 2 (Setups)               | 20          | 5           | 25             | \$40,000.00           |
| <b>Inspections</b>                  |             |             |                |                       |
| Department 1 (Inspections)          | 400         | 100         | 500            | \$187,500.00          |
| Department 2 (Inspections)          | 800         | 200         | 1,000          | \$500,000.00          |
| <b>Power used (kilowatts):</b>      |             |             |                |                       |
| Department 1 (kHw)                  |             |             | 1,200,000      |                       |
| Department 2 (kHw)                  |             |             | 8,800,000      |                       |
| Total kWhs:                         |             |             | 10,000,000     | \$560,000.00          |
| <b>Purchase Orders:</b>             |             |             |                |                       |
| Number of Purchase Orders           | <b>DM-X</b> | <b>DM-Y</b> |                |                       |
|                                     | 400         | 500         | 900            |                       |
| DM-X                                |             |             |                | \$72,000.00           |
| DM-Y                                |             |             |                | \$110,000.00          |
| <b>Building Occupancy</b>           |             |             |                |                       |
| Depreciation                        |             |             | \$1,500,000.00 | \$1,570,000.00        |
| Property Taxes                      |             |             | \$40,000.00    |                       |
| Insurance                           |             |             | \$30,000.00    |                       |
|                                     |             |             | \$1,570,000.00 |                       |
| <b>Square feet occupied: sq ft:</b> | 550,000     |             |                |                       |
| Purchasing                          |             |             | 20,000         |                       |
| Power                               |             |             | 30,000         |                       |
| Department 1                        |             |             | 200,000        |                       |
| Department 2                        |             |             | 300,000        |                       |
|                                     |             |             | <u>550,000</u> |                       |
|                                     |             |             |                | <u>\$9,953,500.00</u> |

\* IDLHs are used to operate machinery, and perform setups and inspections

**TEACHING NOTES: MARTINS MANUFACTURING INC.: AN ADVANCED ABC/ABM CASE, WITH STRATEGIC CONSIDERATIONS**

**PART A: Actual plant-wide MOH rate**

1. Determine the actual plant-wide MOH allocation rate utilizing DLHs.

| Actual MOH     |             |                    |
|----------------|-------------|--------------------|
| Indirect labor |             |                    |
| Department 1:  | \$450,000   |                    |
| Department 2:  | \$200,000   | \$650,000          |
|                | <hr/>       |                    |
| Machine        |             |                    |
| Department 1:  | \$750,000   |                    |
| Department 2:  | \$1,700,000 | \$2,450,000        |
|                | <hr/>       |                    |
| Setups         |             |                    |
| Department 1:  | \$12,000    |                    |
| Department 2:  | \$32,000    | \$44,000           |
|                | <hr/>       |                    |
| Inspections    |             |                    |
| Department 1:  | \$150,000   |                    |
| Department 2:  | \$400,000   | \$550,000          |
|                | <hr/>       |                    |
| Power          |             | \$683,200          |
| Building       |             | \$1,570,000        |
| Purchasing     |             | \$277,600          |
| Total          |             | <u>\$6,224,800</u> |

| Actual Plant-wide MOH rate     | Actual MOH  | Actual DLHs | Actual MOH rate/DLH   |
|--------------------------------|-------------|-------------|-----------------------|
| Total DLHs = Dept. 1 + Dept. 2 | \$6,224,800 | 78,000      | <u>\$79.8051</u> /DLH |

2. Determine the manufacturing costs per unit for P-A and P-B.

| VBC – Actual Plant-wide Rate: Total Calculation | P-A       | P-B         |
|---|-----------|-------------|
|   | 20,000    | 20,000      |
| DM-X:   |           |             |
| P-A units                                       | \$540,000 |             |
| P-B units                                       |           | \$540,000   |
| DM-Y:   |           |             |
| P-A units                                       | \$0       |             |
| P-B units                                       |           | \$2,250,000 |
| DL:   |           |             |
| Department 1:                                   | \$600,000 | \$72,000    |
| Department 2:                                   | \$180,000 | \$216,000   |
|   | \$780,000 | \$288,000   |



|                    |                 |             |                 |                 |
|--------------------|-----------------|-------------|-----------------|-----------------|
| Total Direct Costs |                 | \$1,320,000 |                 | \$3,078,000     |
| MOH                | Allocation Rate |             |                 |                 |
|                    | \$79.8051       | CAB Qty     |                 | CAB Qty         |
| P-A DLHs           |                 | 60,000      | \$4,788,308     |                 |
| P-B DLHs           |                 |             |                 | 18,000          |
| Total cost         |                 |             | \$6,108,308     | \$4,514,492     |
| Number of units    |                 |             | 20,000          | 20,000          |
| Cost per unit      |                 |             | <u>\$305.42</u> | <u>\$225.72</u> |

| VBC Actual Plant-wide Rate: Unit Calculation |                 | P-A             | P-B             |
|--|-----------------|-----------------|-----------------|
| DM-X   | \$27.00         |                 | \$27.00         |
| DM-Y   | \$0.00          | \$27.00         | \$112.50        |
| DL-D1  | \$30.00         |                 | \$3.60          |
| DL-D2  | \$9.00          | \$39.00         | \$10.80         |
| Total Direct Costs                           |                 | \$66.00         | \$153.90        |
| Overhead                                     | Allocation Rate |                 |                 |
|  | \$79.81         | CAB Qty         | CAB Qty         |
| Total Allocated MOH                          |                 | 3.00            | 0.9             |
| Total Unit Cost                              |                 | <u>\$239.42</u> | <u>\$71.82</u>  |
|  |                 | <u>\$305.42</u> | <u>\$225.72</u> |

3. Prices for P-A and P-B were marked up from calculated production costs based on the actual sales mix. Determine the calculated sales prices for P-A and P-B.

|                                  | P-A             | P-B             |
|----------------------------------|-----------------|-----------------|
| Calculated Cost                  | \$305.42        | \$225.72        |
| Markup                           | 10% \$30.54     | 30% \$67.72     |
| SP marked up on calculated costs | <u>\$335.96</u> | <u>\$293.44</u> |

4. Determine the per unit gross profit for P-A and P-B.

|              | P-A               | P-B              |
|--------------|-------------------|------------------|
| SP           | \$335.96          | \$293.44         |
| Direct Costs | (\$66.00)         | (\$153.90)       |
| MOH          |                   |                  |
| Plant-wide   | <u>(\$239.42)</u> | <u>(\$71.82)</u> |
| Total Costs  | (\$305.42)        | (\$225.72)       |
| Gross Profit | <u>\$30.54</u>    | <u>\$67.72</u>   |

**PART B:** Normal/Predetermined/Budgeted plant-wide MOH rate

5. Determine the normal plant-wide MOH allocation rate utilizing DLHs.

| Budgeted MOH   |             |                    |
|----------------|-------------|--------------------|
| Indirect labor |             |                    |
| Department 1:  | \$450,000   |                    |
| Department 2:  | \$160,000   | \$610,000          |
|                | <hr/>       |                    |
| Machine        |             |                    |
| Department 1:  | \$750,000   |                    |
| Department 2:  | \$1,360,000 | \$2,110,000        |
|                | <hr/>       |                    |
| Setups         |             |                    |
| Department 1:  | \$15,000    |                    |
| Department 2:  | \$40,000    | \$55,000           |
|                | <hr/>       |                    |
| Inspections    |             |                    |
| Department 1:  | \$187,500   |                    |
| Department 2:  | \$500,000   | \$687,500          |
|                | <hr/>       |                    |
| Power          |             | \$560,000          |
| Building       |             | \$1,570,000        |
| Purchasing     |             | \$182,000          |
| Total          |             | <u>\$5,774,500</u> |

| Normal Plant-wide MOH rate     | Budgeted MOH | Budgeted DLHs | Normal MOH rate/DLH   |
|--------------------------------|--------------|---------------|-----------------------|
| Total DLHs = Dept. 1 + Dept. 2 | \$5,774,500  | 129,000       | <u>\$44.7636 /DLH</u> |

6. Determine the manufacturing costs per unit for P-A and P-B.

| VBC – Normal Plant-wide Total Calculation | P-A       | 20,000      | P-B       | 20,000      |
|---|-----------|-------------|-----------|-------------|
| DM-X:                                     |           |             |           |             |
| P-A units                                 |           | \$540,000   |           |             |
| P-B units                                 |           |             |           | \$540,000   |
| DM-Y:                                     |           |             |           |             |
| P-A units                                 |           | \$0         |           |             |
| P-B units                                 |           |             |           | \$2,250,000 |
| DL:                                       |           |             |           |             |
| Department 1:                             | \$600,000 |             | \$72,000  |             |
| Department 2:                             | \$180,000 | \$780,000   | \$216,000 | \$288,000   |
| Total Direct Costs                        |           | <hr/>       |           | <hr/>       |
|   |           | \$1,320,000 |           | \$3,078,000 |
| Allocation Rate                           |           |             |           |             |
| Normal MOH Rate                           | \$44.76   | CAB Qty     | CAB Qty   |             |

|                 |        |                    |        |                    |
|-----------------|--------|--------------------|--------|--------------------|
| P-A DLHs        | 60,000 | \$2,685,814        |        |                    |
| P-B DLHs        |        |                    | 18,000 | \$805,744          |
| Total cost      |        | <u>\$4,005,814</u> |        | <u>\$3,883,744</u> |
| Number of units |        | 20,000             |        | 20,000             |
| Cost per unit   |        | <u>\$200.29</u>    |        | <u>\$194.19</u>    |

| VBC Departments -Unit Calculation |                 | P-A     |                 | P-B     |                 |
|-----------------------------------|-----------------|---------|-----------------|---------|-----------------|
| DM-X                              | \$27.00         |         | \$27.00         |         |                 |
| DM-Y                              | \$0.00          | \$27.00 | \$112.50        |         | \$139.50        |
| DL-D1                             | \$30.00         |         | \$3.60          |         |                 |
| DL-D2                             | \$9.00          | \$39.00 | \$10.80         |         | \$14.40         |
| Total Direct Costs                |                 | \$66.00 |                 |         | \$153.90        |
| MOH                               | Allocation Rate | CAB Qty |                 | CAB Qty |                 |
| Total Allocated MOH               | \$44.76         | 3.00    | \$134.29        | 0.9     | \$40.29         |
| Total Unit Cost                   |                 |         | <u>\$200.29</u> |         | <u>\$194.19</u> |

7. Determine any amount of under/over applied MOH.

|                    | Normal Rate | Actual DLHs |             |                      |
|--------------------|-------------|-------------|-------------|----------------------|
| Allocated MOH to A | \$44.7636   | 60,000      | \$2,685,814 |                      |
| Allocated MOH to B | \$44.7636   | 18,000      | \$805,744   | \$3,491,558          |
| Actual MOH         |             |             |             | \$6,224,800          |
| Underallocated MOH |             |             |             | <u>(\$2,733,242)</u> |

8. Prices for P-A and P-B were marked up from calculated production costs based on the budgeted sales mix. Determine the calculated sales prices for P-A and P-B.

|                                  |     | P-A             |     | P-B             |
|----------------------------------|-----|-----------------|-----|-----------------|
| Calculated Cost                  |     | \$200.29        |     | \$194.19        |
| Markup                           | 10% | \$20.03         | 30% | \$58.26         |
| SP marked up on calculated costs |     | <u>\$220.32</u> |     | <u>\$252.44</u> |

9. Determine the per unit gross profit for P-A and P-B.

|              | P-A       | P-B        |
|--------------|-----------|------------|
| SP           | \$220.32  | \$252.44   |
| Direct Costs | (\$66.00) | (\$153.90) |

|                   |                   |                  |
|-------------------|-------------------|------------------|
| MOH               |                   |                  |
| <b>Plant-wide</b> | <u>(\$134.29)</u> | <u>(\$40.29)</u> |
| Total Costs       | (\$200.29)        | (\$194.19)       |
| Gross Profit      | <u>\$20.03</u>    | <u>\$58.26</u>   |

10. Comment on any differences in calculated product costs and gross margins to products A and B due to using an actual MOH allocation rate vs. a normal MOH allocation rate.

The actual plant-wide MOH rate is \$79.81/DLH. The normal plant-wide MOH rate is nearly half of that at \$44.76. This significant change in the plant-wide MOH rate is due to two effects both related to the change in budgeted product mix of 40,000 units of A and 20,000 units of B, to the actual product mix of 20,000 units of A and 20,000 units of B, a 50% reduction in sales of P-A and a 100% increase in sales of P-B.

P-A is a less complex and more labor intensive product compared to P-B. Consequently the reduction in production of P-A significantly reduced the actual quantity of the cost allocation base (CAB) DLHs from the budgeted 128,000 DLHs to 78,000 DLHs. If budgeted DLHs are viewed as a measure of capacity, then the actual 78,000 DLHs reflects an underutilization of this capacity and we would consequently expect to see under allocated MOH which in fact was the case.

The increase in the more complex P-B would result in an increase in actual MOH incurred, i.e., budgeted MOH was \$5,774,400 (based on the budgeted sales mix) but actual MOH was \$6,224,800.

The actual plant-wide MOH of \$79.81/DLH reflects the higher actual plant-wide MOH costs incurred and the lower actual DLHs incurred as compared to the normal plant-wide MOH rate of \$44.76/DLH.

An additional issue arises regarding the marked up sales prices for P-B and especially P-A. There are two effects causing a much greater change in calculated price for P-A than for P-B. The first concerns the absolute amount of MOH allocated to each product. In the actual costing scenario (PART A) all production costs will be absorbed by the actual production. In the normal costing scenario (PART B), MOH is allocated using the lower normal MOH rate which combined with the change in sales mix resulted in significantly fewer DLHs utilized which resulted in underallocated MOH. P-A is labor intensive, utilizing more than three times the DLHs of P-B.

The second effect concerns the relative amount of MOH allocated to each product. Allocated MOH is 2-3 times the direct costs for P-A, while it is only about half the direct costs for P-B, therefore the relative impact is much greater for P-A than for P-B.

### **PART C:** Normal departmental MOH rates using Direct method and Step-down method

11. Allocate support costs to the two operating departments using the direct method.

| Support Departments/Pools |                |
|---------------------------|----------------|
| Building                  | \$1,570,000.00 |
| Power                     | \$560,000.00   |
| Purchasing                | \$182,000.00   |

| Allocations to Operating Departments          |             |                   |                        |
|---|-------------|-------------------|------------------------|
| Direct Method (order based on \$ amount)      |             |                   |                        |
| Building Occupancy: Cost / Square Footage.    | \$1,570,000 | 500,000           | <u>\$3.1400</u> /sq ft |
| Department 1:                                 |             | 200,000           | \$628,000.00           |
| Department 2:                                 |             | 300,000           | \$942,000.00           |
|   |             | <u>500,000</u>    | <u>\$1,570,000</u>     |
| Power: Power Cost / kWh                       | \$560,000   | 10,000,000        | <u>\$0.0560</u> /kWh   |
| Department 1:                                 |             | 1,200,000         | \$67,200.00            |
| Department 2:                                 |             | 8,800,000         | \$492,800.00           |
|   |             | <u>10,000,000</u> | <u>\$560,000</u>       |
| Purchasing: Purchasing Cost / Purchase Orders | \$182,000   | 900               | <u>\$202.2222</u> /PO  |
|   | DM-X        | DM-Y              |                        |
| Department 1                                  | 320         | 80                | \$64,711.11            |
| Department 2                                  | 0           | 500               | \$117,288.89           |
|   | <u>320</u>  | <u>580</u>        | 900 <u>\$182,000</u>   |

12. Determine the normal departmental MOH allocation rates.

| Department 1 - DLHs CAB |                       |
|-------------------------|-----------------------|
| Building - Allocated    | \$628,000.00          |
| Power - Allocated       | \$67,200.00           |
| Purchasing - Allocated  | \$64,711.11           |
|                         | <u>\$759,911.11</u>   |
| Indirect Labor          | \$652,500.00          |
| Machine                 | \$750,000.00          |
|                         | <u>\$1,402,500.00</u> |
|                         | <u>\$2,162,411.11</u> |
| Department 1 - DLHs     | 103,000               |
| Depart 1 Rate / DLHs    | <u>\$20.99</u>        |

| Department 2 - MHs CAB |              |
|------------------------|--------------|
| Building - Allocated   | \$942,000.00 |
| Power - Allocated      | \$492,800.00 |

|                        |                       |                       |
|------------------------|-----------------------|-----------------------|
| Purchasing - Allocated | <u>\$117,288.89</u>   |                       |
|                        |                       | \$1,552,088.89        |
| Indirect Labor         | \$700,000.00          |                       |
| Machine                | <u>\$1,360,000.00</u> |                       |
|                        |                       | \$2,060,000.00        |
|                        |                       | <u>\$3,612,088.89</u> |
| Department 2 - MHs     |                       | 40,000                |
| Depart 2 Rate / MHs    |                       | <u>\$90.30</u>        |

13. Determine the manufacturing costs per unit for P-A and P-B.

| Product Costing Per VBC -Total Calculation |                 |         | P-A              |                    | 20,000 |         | P-B             |                    | 20,000 |  |
|--|-----------------|---------|------------------|--------------------|--------|---------|-----------------|--------------------|--------|--|
| DM-X                                       |                 |         | \$540,000        |                    |        |         | \$540,000       |                    |        |  |
| DM-Y                                       |                 |         | \$0              | \$540,000          |        |         | \$2,250,000     | \$2,790,000        |        |  |
| DL-D1                                      |                 |         | <u>\$600,000</u> |                    |        |         | <u>\$72,000</u> |                    |        |  |
| DL-D2                                      |                 |         | \$180,000        | \$780,000          |        |         | \$216,000       | \$288,000          |        |  |
| Total Direct Costs                         |                 |         |                  | <u>\$1,320,000</u> |        |         |                 | <u>\$3,078,000</u> |        |  |
|  | Allocation Rate | CAB Qty |                  |                    |        | CAB Qty |                 |                    |        |  |
| MOH-D1 (DLHs)                              | \$20.99         | 50,000  | \$1,049,714      |                    |        | 6,000   | \$125,966       |                    |        |  |
| MOH-D2 (MHs)                               | \$90.30         | 10,000  | \$903,022        |                    |        | 40,000  | \$3,612,089     |                    |        |  |
| Total Allocated MOH                        |                 |         |                  | <u>\$1,952,736</u> |        |         |                 | <u>\$3,738,055</u> |        |  |
|  |                 |         |                  | <u>\$3,272,736</u> |        |         |                 | <u>\$6,816,055</u> |        |  |
| Number of units                            |                 |         |                  | 20,000             |        |         |                 | 20,000             |        |  |
| Cost per unit                              |                 |         |                  | <u>\$163.64</u>    |        |         |                 | <u>\$340.80</u>    |        |  |

| VBC Departments -Unit Calculation |                 |         | P-A            |                 | P-B           |                 |
|-----------------------------------|-----------------|---------|----------------|-----------------|---------------|-----------------|
| DM-X                              |                 |         | \$27.00        |                 | \$27.00       |                 |
| DM-Y                              |                 |         | \$0.00         | \$27.00         | \$112.50      | \$139.50        |
| DL-D1                             |                 |         | <u>\$30.00</u> |                 | <u>\$3.60</u> |                 |
| DL-D2                             |                 |         | \$9.00         | \$39.00         | \$10.80       | \$14.40         |
| Total Direct Costs                |                 |         |                | <u>\$66.00</u>  |               | <u>\$153.90</u> |
| Overhead                          | Allocation Rate | CAB Qty |                |                 | CAB Qty       |                 |
| Department 1                      | \$20.99         | 2.50    | \$52.49        |                 | 0.30          | \$6.30          |
| Department 2                      | \$90.30         | 0.50    | \$45.15        |                 | 2.00          | \$180.60        |
| Total Allocated MOH               |                 |         |                | <u>\$97.64</u>  |               | <u>\$186.90</u> |
| Total Unit Cost                   |                 |         |                | <u>\$163.64</u> |               | <u>\$340.80</u> |

14. Determine any amount of under/over applied MOH.

|                     | P-A                   | P-B                   | Total                 |
|---------------------|-----------------------|-----------------------|-----------------------|
| D-1                 | \$1,049,714.13        | \$125,965.70          |                       |
| D-2                 | \$903,022.22          | \$3,612,088.89        |                       |
| Total Allocated MOH | <u>\$1,952,736.35</u> | <u>\$3,738,054.58</u> | \$5,690,790.94        |
| Actual MOH          |                       |                       | \$6,224,800.00        |
| Underallocated MOH  |                       |                       | <u>(\$534,009.06)</u> |

15. Determine the per unit gross profit for P-A and P-B using the sales prices from #3.

|                                   | P-A              | P-B               |
|-----------------------------------|------------------|-------------------|
| Sales Price                       | \$335.96         | \$293.44          |
| Direct Costs                      | (\$66.00)        | (\$153.90)        |
| MOH                               |                  |                   |
| Normal Dept Rates - Direct method | <u>(\$97.64)</u> | <u>(\$186.90)</u> |
| Total Costs                       | (\$163.64)       | (\$340.80)        |
| Gross Profit                      | <u>\$172.32</u>  | <u>(\$47.36)</u>  |

16. Determine the per unit gross profit for P-A and P-B using the sales prices from #8.

|                                   | P-A              | P-B               |
|-----------------------------------|------------------|-------------------|
| Sales Price                       | \$220.32         | \$252.44          |
| Direct Costs                      | (\$66.00)        | (\$153.90)        |
| MOH                               |                  |                   |
| Normal Dept Rates - Direct method | <u>(\$97.64)</u> | <u>(\$186.90)</u> |
| Total Costs                       | (\$163.64)       | (\$340.80)        |
| Gross Profit                      | <u>\$56.68</u>   | <u>(\$88.36)</u>  |

17. Allocate support costs to the two operating departments using the step-down method.

| Support Department/Pools |                |
|--------------------------|----------------|
| Building                 | \$1,570,000.00 |
| Power                    | \$560,000.00   |
| Purchasing               | \$182,000.00   |

| Allocations to Operating Departments        |                |         |                        |
|---|----------------|---------|------------------------|
| Step Down Method (order based on \$ amount) |                |         |                        |
| Building Occupancy: Cost /                  | \$1,570,000.00 | 550,000 | <u>\$2.8545</u> /sq ft |

|  |                |                   |                         |
|--|----------------|-------------------|-------------------------|
| <b>Square Footage.</b>                               |                |                   |                         |
| Power  | 30,000         |                   | \$85,636.36             |
| Purchasing   | 20,000         |                   | \$57,090.91             |
| Department 1:  | 200,000        |                   | \$570,909.09            |
| Department 2:  | 300,000        |                   | \$856,363.64            |
|  | <u>550,000</u> |                   | <u>\$1,570,000.00</u>   |
| <b>Power: Power Cost / kWh</b>                       | \$645,636.36   | 10,000,000        | <u>\$0.0646</u> /kWh    |
| Department 1:  |                | 1,200,000         | \$77,476.36             |
| Department 2:  |                | 8,800,000         | \$568,160.00            |
|  |                | <u>10,000,000</u> | <u>\$645,636.36</u>     |
| <b>Purchasing: Purchasing Cost / Purchase Orders</b> | \$239,090.91   | 900               | <u>\$265.6566</u> /PO   |
|  | <b>DM-X</b>    | <b>DM-Y</b>       |                         |
| Department 1   | 320            | 80                | \$85,010.10             |
| Department 2   | 0              | 500               | \$154,080.81            |
|  | <u>320</u>     | <u>580</u>        | 900 <u>\$239,090.91</u> |

18. Determine the normal departmental MOH allocation rates.

|                                |                       |
|--------------------------------|-----------------------|
| <b>Department 1 - DLHs CAB</b> |                       |
| Building - Allocated           | \$570,909.09          |
| Power - Allocated              | \$77,476.36           |
| Purchasing - Allocated         | \$85,010.10           |
|                                | <u>\$733,395.56</u>   |
| Indirect Labor                 | \$652,500.00          |
| Machine                        | \$750,000.00          |
|                                | <u>\$1,402,500.00</u> |
|                                | <u>\$2,135,895.56</u> |
| Department 1 - DLHs            | 103,000               |
| Depart 1 Rate / DLHs           | <u>\$20.74</u>        |

|                               |                       |
|-------------------------------|-----------------------|
| <b>Department 2 - MHs CAB</b> |                       |
| Building - Allocated          | \$856,363.64          |
| Power - Allocated             | \$568,160.00          |
| Purchasing - Allocated        | \$154,080.81          |
|                               | <u>\$1,578,604.44</u> |



Journal of Business Cases and Applications

|                            |                |                       |
|----------------------------|----------------|-----------------------|
| Indirect Labor             | \$700,000.00   |                       |
| Machine                    | \$1,360,000.00 |                       |
|                            |                | \$2,060,000.00        |
|                            |                | <u>\$3,638,604.44</u> |
| Department 2 - MHs         |                | 40,000                |
| <b>Depart 2 Rate / MHs</b> |                | <u><b>\$90.97</b></u> |

19. Determine the manufacturing costs per unit for P-A and P-B.

| Product Costing Per VBC -Total Calculation |                 |         | P-A              | 20,000             | P-B             | 20,000             |
|--|-----------------|---------|------------------|--------------------|-----------------|--------------------|
| DM-X                                       |                 |         | \$540,000        |                    | \$540,000       |                    |
| DM-Y                                       |                 |         | \$0              | \$540,000          | \$2,250,000     | \$2,790,000        |
| DL-D1                                      |                 |         | <u>\$600,000</u> |                    | <u>\$72,000</u> |                    |
| DL-D2                                      |                 |         | \$180,000        | \$780,000          | \$216,000       | \$288,000          |
| Total Direct Costs                         |                 |         |                  | \$1,320,000        |                 | \$3,078,000        |
|  | Allocation Rate | CAB Qty |                  |                    | CAB Qty         |                    |
| MOH-D1 (DLHs)                              | \$20.74         | 50,000  | \$1,036,843      |                    | 6,000           | \$124,421          |
| MOH-D2 (MHs)                               | \$90.97         | 10,000  | \$909,651        |                    | 40,000          | \$3,638,604        |
| Total Allocated MOH                        |                 |         |                  | <u>\$1,946,494</u> |                 | <u>\$3,763,026</u> |
| Total Cost                                 |                 |         |                  | \$3,266,494        |                 | \$6,841,026        |
| Number of units                            |                 |         |                  | 20,000             |                 | 20,000             |
| Cost per unit                              |                 |         |                  | <u>\$163.32</u>    |                 | <u>\$342.05</u>    |

| VBC Departments -Unit Calculation |                 |      | P-A             | P-B             |
|-----------------------------------|-----------------|------|-----------------|-----------------|
| DM-X                              |                 |      | \$27.00         | \$27.00         |
| DM-Y                              |                 |      | \$0.00          | \$112.50        |
|                                   |                 |      |                 | <u>\$139.50</u> |
| DL-D1                             |                 |      | \$30.00         | \$3.60          |
| DL-D2                             |                 |      | \$9.00          | \$10.80         |
| Total Direct Costs                |                 |      | <u>\$66.00</u>  | <u>\$153.90</u> |
| Overhead                          | Allocation Rate | CAB  |                 | CAB             |
| Department 1                      | \$20.74         | 2.50 | \$51.84         | 0.30            |
| Department 2                      | \$90.97         | 0.50 | \$45.48         | 2.00            |
| Total Allocated MOH               |                 |      | <u>\$97.32</u>  | <u>\$188.15</u> |
| Total Unit Cost                   |                 |      | <u>\$163.32</u> | <u>\$342.05</u> |

20. Determine any amount of under/over applied MOH.

|                     | P-A                   | P-B                   | Total                 |
|---------------------|-----------------------|-----------------------|-----------------------|
| D-1                 | \$1,036,842.50        | \$124,421.10          |                       |
| D-2                 | \$909,651.11          | \$3,638,604.44        |                       |
| Total Allocated MOH | <u>\$1,946,493.61</u> | <u>\$3,763,025.54</u> | \$5,709,519.16        |
| Actual MOH          |                       |                       | \$6,224,800.00        |
| Underallocated MOH  |                       |                       | <u>(\$515,280.84)</u> |

21. Determine the per unit gross profit for P-A and P-B using the sales prices from #3.

|                                   | P-A              | P-B               |
|-----------------------------------|------------------|-------------------|
| Sales Price                       | \$335.96         | \$293.44          |
| Direct Costs                      | (\$66.00)        | (\$153.90)        |
| MOH                               |                  |                   |
| Normal Dept Rates - Direct method | <u>(\$97.32)</u> | <u>(\$188.15)</u> |
| Total Costs                       | (\$163.32)       | (\$342.05)        |
| Gross Profit                      | <u>\$172.64</u>  | <u>(\$48.61)</u>  |

22. Determine the per unit gross profit for P-A and P-B using the sales prices from #8.

|                                   | P-A              | P-B               |
|-----------------------------------|------------------|-------------------|
| Sales Price                       | \$220.32         | \$252.44          |
| Direct Costs                      | (\$66.00)        | (\$153.90)        |
| MOH                               |                  |                   |
| Normal Dept Rates - Direct method | <u>(\$97.32)</u> | <u>(\$188.15)</u> |
| Total Costs                       | (\$163.32)       | (\$342.05)        |
| Gross Profit                      | <u>\$57.00</u>   | <u>(\$89.61)</u>  |

23. Comment on any differences in calculated product costs and gross margins to products A and B due to using the direct allocation method vs. the step-down allocation method and with respect to using the single plant-wide MOH rate versus the two departmental MOH rates.

The impact of using the direct method versus the step-down method to allocate support costs is insignificant. However, the consequence of separating support costs from operating costs and using two normal departmental MOH (PART C) rates versus simply accumulating all MOH costs into one plant-wide pool (PART A & B) is significant. Specifically costs allocated to P-A have decreased significantly while costs allocated to P-B have increased significantly.

#### **PART D: Activity Based Costing**

24. Determine the normal activity allocation rates.

Prior to being able to determine the activity allocation rates, the three resource pools must be allocated to the intermediate cost objects (departments and materials).

| FIRST STAGE ALLOCATIONS                    |                |                |                        |
|--|----------------|----------------|------------------------|
| Building Occupancy: Cost / Square Footage. | \$1,570,000.00 | 550,000        | <u>\$2.8545</u> /sq ft |
| Purchasing                                 | \$2.8545       | 20,000         | \$57,090.91            |
| Power                                      | \$2.8545       | 30,000         | \$85,636.36            |
| Department 1                               | \$2.8545       | 200,000        | \$570,909.09           |
| Department 2                               | \$2.8545       | 300,000        | \$856,363.64           |
|  |                | <u>550,000</u> | <u>\$1,570,000.00</u>  |

|   |            |              |                       |
|---|------------|--------------|-----------------------|
| Purchasing: Direct costs + Allocated building occupancy | \$239,091  | 900          | <u>\$265.6566</u> /PO |
| Purchasing Cost / Purchase Orders                       |            | Pur Orders   | Alloc Cost            |
| Material X:   | \$265.6566 | 320          | \$85,010.10           |
| Material Y:   | \$265.6566 | 1,000        | \$265,656.57          |
|   |            | <u>1,320</u> | <u>\$350,666.67</u>   |

|  |           |                   |                      |
|--|-----------|-------------------|----------------------|
| Power: Direct costs + Allocated building occupancy | \$645,636 | 10,000,000        | <u>\$0.0646</u> /kWh |
| Power Cost / kWh                                   |           | Power             | Alloc Cost           |
| Department 1:                                      | \$0.0646  | 1,200,000         | \$77,476.36          |
| Department 2:                                      | \$0.0646  | 11,000,000        | \$710,200.00         |
|  |           | <u>12,200,000</u> | <u>\$787,676.36</u>  |

| Indirect labor (IDLHs CAB)      |                  |
|---------------------------------|------------------|
| Department 1 Budgeted IDL Costs | \$450,000.00     |
| Budgeted IDLHs                  | 30,000           |
| Department 1 - IDL rate         | <u>\$15.0000</u> |
| Department 2 Budgeted IDL Costs | \$160,000.00     |
| Budgeted IDLHs                  | 8,000            |
| Department 2 - IDL rate         | <u>\$20.0000</u> |

| Machinery-related (MHs CAB)         |                  |
|-------------------------------------|------------------|
| Department 1 Budgeted Machine Costs | \$750,000.00     |
| Budgeted MHs                        | 30,000           |
| Department 1 - Machine Rate         | <u>\$25.0000</u> |

|                                     |                  |
|-------------------------------------|------------------|
| Department 2 Budgeted Machine Costs | \$1,360,000.00   |
| Budgeted MHs                        | 40,000           |
| Department 2 - Machine Rate         | <u>\$34.0000</u> |

|                                     |                     |
|-------------------------------------|---------------------|
| <b>Setups (departmental setups)</b> |                     |
| Department 1 Budgeted Setup Costs   | \$15,000.00         |
| Budgeted Setups                     | 20                  |
| Department 1 - Setup Rate           | <u>\$750.0000</u>   |
| Department 2 Budgeted Setup Costs   | \$40,000.00         |
| Budgeted Setups                     | 25                  |
| Department 2 - Setup Rate           | <u>\$1,600.0000</u> |

|  |                   |
|--|-------------------|
| <b>Inspections(departmental inspections)</b> |                   |
| Department 1 Budgeted Inspection Costs       | \$187,500.00      |
| Budgeted Inspections                         | 500               |
| Department 1 - Inspection Rate               | <u>\$375.0000</u> |
| Department 2 Budgeted Inspection Costs       | \$500,000.00      |
| Budgeted Inspections                         | 1,000             |
| Department 2 - Inspection Rate               | <u>\$500.0000</u> |

|                                    |                  |
|------------------------------------|------------------|
| <b>Power (MHs CAB)</b>             |                  |
| Department 1 Allocated Power Costs | \$77,476.36      |
| Budgeted MHs                       | 30,000           |
| Department 1 - Power rate          | <u>\$2.5825</u>  |
| Department 2 Allocated Power Costs | \$710,200.00     |
| Budgeted MHs                       | 40,000           |
| Department 2 - Power rate          | <u>\$17.7550</u> |

|                                       |                  |
|---------------------------------------|------------------|
| <b>Building occupancy (MHs CAB)</b>   |                  |
| Department 1 Allocated Building Costs | \$570,909.09     |
| Budgeted MHs                          | 30,000           |
| Department 1 - Building Rate          | <u>\$19.0303</u> |
| Department 2 Allocated Building Costs | \$856,363.64     |
| Budgeted MHs                          | 40,000           |
| Department 2 - Building Rate          | <u>\$21.4091</u> |

| Purchasing (Unit CAB)            |                   |
|----------------------------------|-------------------|
| Purchase Costs Allocated to DM-X | \$85,010.10       |
| DM-X Purchase Orders             | 400               |
| DM-X Purchase Order Rate         | <u>\$212.5253</u> |
| Purchase Costs Allocated to DM-Y | \$265,656.57      |
| DM-X Purchase Orders             | 500               |
| DM-X Purchase Order Rate         | <u>\$531.3131</u> |

25. Determine the manufacturing costs per unit for P-A and P-B.

| Product Costing Per ABC -Total Calculation |                 |         |              | P-A          | 20,000      | P-B         | 20,000         |
|--|-----------------|---------|--------------|--------------|-------------|-------------|----------------|
| DM-X                                       |                 |         |              | \$540,000    |             | \$540,000   |                |
| DM-Y                                       |                 |         |              | \$0          | \$540,000   | \$2,250,000 | \$2,790,000    |
| DL-D1                                      |                 |         |              | \$600,000    |             | \$72,000    |                |
| DL-D2                                      |                 |         |              | \$180,000    | \$780,000   | \$216,000   | \$288,000      |
| Total Direct Costs                         |                 |         |              |              | \$1,320,000 |             | \$3,078,000    |
| MOH  | Allocation Rate | CAB Qty |              |              |             | CAB Qty     |                |
| Indirect Labor                             |                 |         |              |              |             |             |                |
| Dept 1                                     | \$15.0000       | 10,000  | \$150,000.00 |              |             | 20,000      | \$300,000.00   |
| Dept 2                                     | \$20.0000       | 2,000   | \$40,000.00  | \$190,000.00 |             | 8,000       | \$160,000.00   |
| Machine Costs                              |                 |         |              |              |             |             |                |
| Dept 1                                     | \$25.0000       | 10,000  | \$250,000.00 |              |             | 20,000      | \$500,000.00   |
| Dept 2                                     | \$34.0000       | 10,000  | \$340,000.00 | \$590,000.00 |             | 40,000      | \$1,360,000.00 |
| Setups                                     |                 |         |              |              |             |             |                |
| Dept 1                                     | \$750.0000      | 8       | \$6,000.00   |              |             | 8           | \$6,000.00     |
| Dept 2                                     | \$1,600.0000    | 10      | \$16,000.00  | \$22,000.00  |             | 10          | \$16,000.00    |
| Inspections                                |                 |         |              |              |             |             |                |
| Dept 1                                     | \$375.0000      | 200     | \$75,000.00  |              |             | 200         | \$75,000.00    |
| Dept 2                                     | \$500.0000      | 400     | \$200,000.00 | \$275,000.00 |             | 400         | \$200,000.00   |
| Power                                      |                 |         |              |              |             |             |                |
| Dept 1                                     | \$2.5825        | 10,000  | \$25,825.45  |              |             | 20,000      | \$51,650.91    |
| Dept 2                                     | \$17.7550       | 10,000  | \$177,550.00 | \$203,375.45 |             | 40,000      | \$710,200.00   |
| Occupancy                                  |                 |         |              |              |             |             |                |
| Dept 1                                     | \$19.0303       | 10,000  | \$190,303.03 |              |             | 20,000      | \$380,606.06   |
| Dept 2                                     | \$21.4091       | 10,000  | \$214,090.91 | \$404,393.94 |             | 40,000      | \$856,363.64   |
| Purchases                                  |                 |         |              |              |             |             |                |
| DM-X                                       | \$212.5253      | 160     | \$34,004.04  |              |             | 160         | \$34,004.04    |
| DM-Y                                       | \$531.3131      | 0       | \$0.00       | \$34,004.04  |             | 1,000       | \$531,313.13   |

Journal of Business Cases and Applications

|                     |                 |                 |
|---------------------|-----------------|-----------------|
| Total Allocated MOH | \$1,718,773.43  | \$5,181,137.78  |
| Total product costs | \$3,038,773.43  | \$8,259,137.78  |
| Number of units     | 20,000          | \$20,000        |
| Cost per unit       | <u>\$151.94</u> | <u>\$412.96</u> |

| ABC -Unit Calculation       | Rate    | CAB Qty | P-A             | CAB Qty | P-B             |
|-----------------------------|---------|---------|-----------------|---------|-----------------|
| DM-X                        | \$6.75  | 4       | \$27.00         | 4       | \$27.00         |
| DM-Y                        | \$11.25 | 0       | \$27.00         | 10      | \$112.50        |
| DL-D1                       | \$12.00 | 2.5     | \$30.00         | 0.3     | \$3.60          |
| DL-D2                       | \$18.00 | 0.5     | \$9.00          | 0.6     | \$10.80         |
| Total Direct Costs          |         |         | \$66.00         |         | \$153.90        |
| Allocated MOH               |         |         |                 |         |                 |
| IDL-D1 (IDLHs CAB)          | \$15.00 | 0.50    | \$7.50          | 1.00    | \$15.00         |
| IDL-D2 (IDLHs CAB)          | \$20.00 | 0.10    | \$2.00          | 0.40    | \$8.00          |
| MH-D1 (MHs CAB)             | \$25.00 | 0.50    | \$12.50         | 1.00    | \$25.00         |
| MH-D2 (MHs CAB)             | \$34.00 | 0.50    | \$17.00         | 2.00    | \$68.00         |
| Setup-D1(Setups)            | \$15.00 | 0.02    | \$0.30          | 0.02    | \$0.30          |
| Setup-D2(Setups)            | \$20.00 | 0.04    | \$0.80          | 0.04    | \$0.80          |
| Inspections-D1(Inspections) | \$15.00 | 0.25    | \$3.75          | 0.25    | \$3.75          |
| Inspections-D2(Inspections) | \$20.00 | 0.50    | \$10.00         | 0.50    | \$10.00         |
| Power-D1 (MH CAB)           | \$2.58  | 0.50    | \$1.29          | 1.00    | \$2.58          |
| Power-D2 (MH CAB)           | \$17.76 | 0.50    | \$8.88          | 2.00    | \$35.51         |
| Purchasing-DM-X             | \$0.43  | 4.00    | \$1.70          | 4.00    | \$1.70          |
| Purchasing-DM-Y             | \$2.66  | 0       | \$0.00          | 10.00   | \$26.57         |
| Building-D1 (MH CAB)        | \$19.03 | 0.50    | \$9.52          | 1.00    | \$19.03         |
| Building-D2 (MH CAB)        | \$21.41 | 0.50    | \$10.70         | 2.00    | \$42.82         |
| Total Allocated MOH         |         |         | \$85.94         |         | \$259.06        |
| Total Unit Cost             |         |         | <u>\$151.94</u> |         | <u>\$412.96</u> |

26. Determine any amount of under/over applied MOH.

|                     | P-A            | P-B            | Allocated MOH  | Actual MOH            | (Under)/Over Allocated |
|---------------------|----------------|----------------|----------------|-----------------------|------------------------|
| Indirect Labor      |                |                |                |                       |                        |
| Dept 1              | \$150,000.00   | \$300,000.00   |                |                       |                        |
| Dept 2              | \$40,000.00    | \$160,000.00   | \$650,000.00   | \$650,000.00          | \$0.00                 |
| Machine Costs       |                |                |                |                       |                        |
| Dept 1              | \$250,000.00   | \$500,000.00   |                |                       |                        |
| Dept 2              | \$340,000.00   | \$1,360,000.00 | \$2,450,000.00 | \$2,450,000.00        | \$0.00                 |
| Setups              |                |                |                |                       |                        |
| Dept 1              | \$6,000.00     | \$6,000.00     |                |                       |                        |
| Dept 2              | \$16,000.00    | \$16,000.00    | \$44,000.00    | \$44,000.00           | \$0.00                 |
| Inspections         |                |                |                |                       |                        |
| Dept 1              | \$75,000.00    | \$75,000.00    |                |                       |                        |
| Dept 2              | \$200,000.00   | \$200,000.00   | \$550,000.00   | \$550,000.00          | \$0.00                 |
| Power               |                |                |                |                       |                        |
| Dept 1              | \$25,825.45    | \$51,650.91    |                |                       |                        |
| Dept 2              | \$177,550.00   | \$710,200.00   | \$965,226.36   | \$683,200.00          | \$282,026.36           |
| Occupancy           |                |                |                |                       |                        |
| Dept 1              | \$190,303.03   | \$380,606.06   |                |                       |                        |
| Dept 2              | \$214,090.91   | \$856,363.64   | \$1,641,363.64 | \$1,570,000.00        | \$71,363.64            |
| Purchases           |                |                |                |                       |                        |
| DM-X                | \$34,004.04    | \$34,004.04    |                |                       |                        |
| DM-Y                | \$0.00         | \$531,313.13   | \$599,321.21   | \$277,600.00          | \$321,721.21           |
| Total Allocated MOH | \$1,718,773.43 | \$5,181,137.78 | \$6,899,911.21 | <u>\$6,224,800.00</u> | \$675,111.21           |

27. Determine the per unit gross profit for P-A and P-B using the sales prices from #3.

|              | P-A        | P-B        |
|--------------|------------|------------|
| Sales Price  | \$335.96   | \$293.44   |
| Direct Costs | (\$66.00)  | (\$153.90) |
| MOH          |            |            |
| ABC          | (\$85.94)  | (\$259.06) |
| Total Costs  | (\$151.94) | (\$412.96) |
| Gross Profit | \$184.02   | (\$119.51) |

28. Determine the per unit gross profit for P-A and P-B using the sales prices from #8.

|  | P-A | P-B |
|--|-----|-----|
|--|-----|-----|

|              |            |            |
|--------------|------------|------------|
| Sales Price  | \$220.32   | \$252.44   |
| Direct Costs | (\$66.00)  | (\$153.90) |
| MOH          |            |            |
| ABC          | (\$85.94)  | (\$259.06) |
| Total Costs  | (\$151.94) | (\$412.96) |
| Gross Profit | \$68.38    | (\$160.51) |

29. Comment on any differences in calculated product costs and gross margins to products P-A and P-B due to using the ABC model versus the departmental model.

Allocated MOH has shifted from under-allocated using the normal departmental rates to over-allocated using the ABC activity rates. In the departmental model, due to the change in the sales mix, department 1 costs would be under-allocated due to the reduction in actual DLHs and department 2 costs would be over-allocated due to the increase in actual MHs.

The ABC system and use of activity rates eliminates the distortions in department 1 and 2 allocations. Furthermore there are no under/over allocations of indirect labor, machine costs, setups or inspections. This is because these are variable costs (indirect labor and machine costs are unit level costs whereas setup and inspection are batch level costs) and assuming no change in input costs or productivity, the amounts allocated would be equal to the actual amounts incurred. Power and purchases are also variable costs but they are allocated based on MHs which increased due to the change in sales mix, so that would lead to over-allocation. Occupancy costs are facility sustaining costs which are also allocated on MHs and which were consequently over-allocated. This illustrates the fact that allocated costs, regardless of their cost behavior, are “flexed” and treated as variable costs, in this case allocated based on MHs.

### **PART E: Activity Based Costing vs Activity Based Management**

30. Streamline/redesign the ABC system.

The two batch activities of setups and inspections exclusively utilize IDLHs, therefore these activity pools can be merged into the indirect labor activity pool. The power and occupancy activity pools are allocated using MHs so they can be merged into the machine cost activity pool. The first stage allocation of occupancy, purchasing and power resource pools remains the same. There are now only six second stage activity pools: indirect labor for each department, machine costs for each department, and purchasing for each product.

31. Determine the normal activity allocation rates.

| FIRST STAGE ALLOCATIONS                    |                |           |                        |
|--|----------------|-----------|------------------------|
| Building Occupancy: Cost / Square Footage. | \$1,570,000.00 | 550,000   | <u>\$2.8545</u> /sq ft |
|  |                | Occupancy | Allocated Cost         |
| Purchasing                                 | \$2.8545       | 20,000    | \$57,090.91            |
| Power                                      | \$2.8545       | 30,000    | \$85,636.36            |



Journal of Business Cases and Applications

|              |          |                |                       |
|--------------|----------|----------------|-----------------------|
| Department 1 | \$2.8545 | 200,000        | \$570,909.09          |
| Department 2 | \$2.8545 | 300,000        | \$856,363.64          |
|              |          | <u>550,000</u> | <u>\$1,570,000.00</u> |

|   |            |                   |                       |
|---|------------|-------------------|-----------------------|
| Purchasing: Direct costs + Allocated building occupancy | \$239,091  | 900               | <u>\$265.6566</u> /PO |
| Purchasing Cost / Purchase Orders                       |            | <b>Pur Orders</b> | <b>Allocated Cost</b> |
| Material X:   | \$265.6566 | 320               | \$85,010.10           |
| Material Y:   | \$265.6566 | 1,000             | \$265,656.57          |
|   |            | <u>1,320</u>      | <u>\$350,666.67</u>   |

|  |           |                   |                       |
|--|-----------|-------------------|-----------------------|
| Power: Direct costs + Allocated building occupancy | \$645,636 | 10,000,000        | <u>\$0.0646</u> /kWh  |
| Power Cost / kWh                                   |           | <b>Power</b>      | <b>Allocated Cost</b> |
| Department 1:                                      | \$0.0646  | 1,200,000         | \$77,476.36           |
| Department 2:                                      | \$0.0646  | 11,000,000        | \$710,200.00          |
|  |           | <u>12,200,000</u> | <u>\$787,676.36</u>   |

|                                   |                  |
|-----------------------------------|------------------|
| <b>Indirect labor (IDLHs CAB)</b> |                  |
| Department 1 Budgeted IDL Costs   | \$652,500.00     |
| Budgeted IDLHs                    | 43,500           |
| Department 1 - IDL rate           | <u>\$15.0000</u> |
| Department 2 Budgeted IDL Costs   | \$700,000.00     |
| Budgeted IDLHs                    | 35,000           |
| Department 2 - IDL rate           | <u>\$20.0000</u> |

|                                     |                  |
|-------------------------------------|------------------|
| <b>Machinery-related (MHs CAB)</b>  |                  |
| Department 1 Budgeted Machine Costs | \$750,000.00     |
| Allocated Power Costs               | \$77,476.36      |
| Allocated Occupancy Costs           | \$570,909.09     |
| Total Department 1 Costs            | \$1,398,385.45   |
| Budgeted MHs                        | 30,000           |
| Department 1 - Machine Rate         | <u>\$46.6128</u> |
| Department 2 Budgeted Machine Costs | \$1,360,000.00   |
| Allocated Power Costs               | \$710,200.00     |
| Allocated Occupancy Costs           | \$856,363.64     |
| Total Department 1 Costs            | \$2,926,563.64   |
| Budgeted MHs                        | 40,000           |

|                             |                  |
|-----------------------------|------------------|
| Department 2 - Machine Rate | <u>\$73.1641</u> |
|-----------------------------|------------------|

| Purchasing (Unit CAB)            |                   |
|----------------------------------|-------------------|
| Purchase Costs Allocated to DM-X | \$85,010.10       |
| DM-X Purchase Orders             | 400               |
| DM-X Purchase Order Rate         | <u>\$212.5253</u> |
| Purchase Costs Allocated to DM-Y | \$265,656.57      |
| DM-X Purchase Orders             | 500               |
| DM-X Purchase Order Rate         | <u>\$531.3131</u> |

32. Determine the manufacturing costs per unit for P-A and P-B.

| Product Costing Per ABC -Total Calculation |                 | P-A       |              | 20,000          | P-B         |                | 20,000          |
|--|-----------------|-----------|--------------|-----------------|-------------|----------------|-----------------|
| DM-X                                       |                 | \$540,000 |              |                 | \$540,000   |                |                 |
| DM-Y                                       |                 | \$0       |              | \$540,000       | \$2,250,000 |                | \$2,790,000     |
| DL-D1                                      |                 | \$600,000 |              |                 | \$72,000    |                |                 |
| DL-D2                                      |                 | \$180,000 |              | \$780,000       | \$216,000   |                | \$288,000       |
| Total Direct Costs                         |                 |           |              | \$1,320,000     |             |                | \$3,078,000     |
| MOH  | Allocation Rate | CAB Qty   |              |                 | CAB Qty     |                |                 |
| Indirect Labor                             |                 |           |              |                 |             |                |                 |
| Dept 1                                     | \$15.0000       | 15,400    | \$231,000.00 |                 | 25,400      | \$381,000.00   |                 |
| Dept 2                                     | \$20.0000       | 12,800    | \$256,000.00 | \$487,000.00    | 18,800      | \$376,000.00   | \$757,000.00    |
| Machine Costs                              |                 |           |              |                 |             |                |                 |
| Dept 1                                     | \$46.6128       | 10,000    | \$466,128.48 |                 | 20,000      | \$932,256.97   |                 |
| Dept 2                                     | \$73.1641       | 10,000    | \$731,640.91 | \$1,197,769.39  | 40,000      | \$2,926,563.64 | \$3,858,820.61  |
| Purchases                                  |                 |           |              |                 |             |                |                 |
| DM-X                                       | \$212.5253      | 160       | \$34,004.04  |                 | 160         | \$34,004.04    |                 |
| DM-Y                                       | \$531.3131      | 0         | \$0.00       | \$34,004.04     | 1,000       | \$531,313.13   | \$565,317.17    |
| Total Allocated MOH                        |                 |           |              | \$1,718,773.43  |             |                | \$5,181,137.78  |
| Total product costs                        |                 |           |              | \$3,038,773.43  |             |                | \$8,259,137.78  |
| Number of units                            |                 |           |              | 20,000          |             |                | 20,000          |
| Cost per unit                              |                 |           |              | <u>\$151.94</u> |             |                | <u>\$412.96</u> |

| ABC -Unit Calculation | Rate    | CAB Qty | P-A     | CAB Qty | P-B      |
|-----------------------|---------|---------|---------|---------|----------|
| DM-X                  | \$6.75  | 4       | \$27.00 | 4       | \$27.00  |
| DM-Y                  | \$11.25 | 0       | \$27.00 | 10      | \$112.50 |
| DL-D1                 | \$12.00 | 2.5     | \$30.00 | 0.3     | \$3.60   |

Journal of Business Cases and Applications

|                     |         |      |         |          |       |          |          |
|---------------------|---------|------|---------|----------|-------|----------|----------|
| DL-D2               | \$18.00 | 0.5  | \$9.00  | \$39.00  | 0.6   | \$10.80  | \$14.40  |
| Total Direct Costs  |         |      |         | \$66.00  |       |          | \$153.90 |
| Allocated MOH       |         |      |         |          |       |          |          |
| IDL-D1 (IDLHs CAB)  | \$15.00 | 0.77 | \$11.55 |          | 1.27  | \$19.05  |          |
| IDL-D2 (IDLHs CAB)  | \$20.00 | 0.64 | \$12.80 | \$24.35  | 0.94  | \$18.80  | \$37.85  |
| MH-D1 (MHs CAB)     | \$46.61 | 0.50 | \$23.31 |          | 1.00  | \$46.61  |          |
| MH-D2 (MHs CAB)     | \$73.16 | 0.50 | \$36.58 | \$59.89  | 2.00  | \$146.33 | \$192.94 |
| Purchasing-DM-X     | \$0.43  | 4.00 | \$1.70  |          | 4.00  | \$1.70   |          |
| Purchasing-DM-Y     | \$2.66  | 0    | \$0.00  | \$1.70   | 10.00 | \$26.57  | \$28.27  |
| Total Allocated MOH |         |      |         | \$85.94  |       |          | \$259.06 |
| Total Unit Cost     |         |      |         | \$151.94 |       |          | \$412.96 |

33. Determine any amount of under/over applied MOH.

|                     | P-A            | P-B            | Total          |
|---------------------|----------------|----------------|----------------|
| Indirect Labor      |                |                |                |
| Dept 1              | \$231,000.00   | \$381,000.00   | \$612,000.00   |
| Dept 2              | \$256,000.00   | \$376,000.00   | \$632,000.00   |
| Machine Costs       |                |                |                |
| Dept 1              | \$466,128.48   | \$932,256.97   | \$1,398,385.45 |
| Dept 2              | \$731,640.91   | \$2,926,563.64 | \$3,658,204.55 |
| Purchases           |                |                |                |
| DM-X                | \$34,004.04    | \$34,004.04    | \$68,008.08    |
| DM-Y                | \$0.00         | \$531,313.13   | \$531,313.13   |
| Total Allocated MOH | \$1,718,773.43 | \$5,181,137.78 | \$6,899,911.21 |
| Actual MOH          |                |                | \$6,224,800.00 |
| Overallocated MOH   |                |                | \$675,111.21   |

34. Determine the per unit gross profit for P-A and P-B using the sales prices from #3.

|              | P-A        | P-B        |
|--------------|------------|------------|
| Sales Price  | \$335.96   | \$293.44   |
| Direct Costs | (\$66.00)  | (\$153.90) |
| MOH          |            |            |
| ABC          | (\$85.94)  | (\$259.06) |
| Total Costs  | (\$151.94) | (\$412.96) |

|              |          |            |
|--------------|----------|------------|
| Gross Profit | \$184.02 | (\$119.51) |
|--------------|----------|------------|

35. Determine the per unit gross profit for P-A and P-B using the sales prices from #8.

|              | P-A        | P-B        |
|--------------|------------|------------|
| Sales Price  | \$220.32   | \$252.44   |
| Direct Costs | (\$66.00)  | (\$153.90) |
| MOH          |            |            |
| ABC          | (\$85.94)  | (\$259.06) |
| Total Costs  | (\$151.94) | (\$412.96) |
| Gross Profit | \$68.38    | (\$160.51) |

36. Comment on any differences in calculated product costs and gross margins to products P-A and P-B due to using the original ABC system with the streamlined ABC system. Under what scenarios would each system be most appropriate?

There are two objectives to product costing. The first is to accurately capture resource consumption and the second is to provide information for process improvement, i.e., the first is to “cost” the cost object and the second is to “manage the cost”.

Which ABC system MMI should use depends on what its objective is. The calculated costs for P-A and P-B are identical in both ABC systems and therefore if the objective is simply to “cost” the products then the streamlined ABC system is most appropriate. However if the objective is to understand the demand which products make on activities (Activity-Based-Management) then original ABC system should be used.

37. All the costing systems developed have been designed to comply with GAAP. If MMI were to relax this constraint, in what way might the ABC system be modified.

Occupancy costs are facility sustaining costs and are “driven” by the fact that the facility exists. Therefore there is no appropriate allocation base and the use of any allocation, such as square footage as in this case, will be arbitrary and will simply distort the calculated product costs. The larger the cost the greater the distortion. In this case occupancy costs are 25% of MOH costs.

The ABC system’s accuracy would be improved by not treating occupancy costs as a product cost to be allocated to the product.

38. Compare the GAAP based and non-GAAP based ABC systems, and comment on any differences.

| First Stage Allocations           |            |            |                       |
|-----------------------------------|------------|------------|-----------------------|
| Purchasing:                       | \$182,000  | 900        | <u>\$202.2222</u> /PO |
| Purchasing Cost / Purchase Orders |            | Pur Orders | Allocated Cost        |
| Material X:                       | \$202.2222 | 320        | \$64,711.11           |
| Material Y:                       | \$202.2222 | 1,000      | \$202,222.22          |
|                                   |            | 1,320      | <u>\$266,933.33</u>   |

|                  |           |            |                      |
|------------------|-----------|------------|----------------------|
| Power:           | \$560,000 | 10,000,000 | <u>\$0.0560</u> /kWh |
| Power Cost / kWh |           | Power      | Allocated Cost       |
| Department 1:    | \$0.0560  | 1,200,000  | \$67,200.00          |
| Department 2:    | \$0.0560  | 11,000,000 | \$616,000.00         |
|                  |           | 12,200,000 | <u>\$683,200.00</u>  |

Second stage activity allocation rates:

| Indirect labor (IDLHs CAB)      |                  |
|---------------------------------|------------------|
| Department 1 Budgeted IDL Costs | \$652,500.00     |
| Budgeted IDLHs                  | 43,500           |
| Department 1 - IDL rate         | <u>\$15.0000</u> |
| Department 2 Budgeted IDL Costs | \$700,000.00     |
| Budgeted IDLHs                  | 35,000           |
| Department 2 - IDL rate         | <u>\$20.0000</u> |

| Machinery-related (MHs CAB)         |                  |
|-------------------------------------|------------------|
| Department 1 Budgeted Machine Costs | \$750,000.00     |
| Allocated Power Costs               | \$67,200.00      |
| Total Department 1 Costs            | \$817,200.00     |
| Budgeted MHs                        | 30,000           |
| Department 1 - Machine Rate         | <u>\$27.2400</u> |
| Department 2 Budgeted Machine Costs | \$1,360,000.00   |
| Allocated Power Costs               | \$616,000.00     |
| Total Department 1 Costs            | \$1,976,000.00   |
| Budgeted MHs                        | 40,000           |
| Department 2 - Machine Rate         | <u>\$49.4000</u> |

| Purchasing (Unit CAB)            |     |                   |
|----------------------------------|-----|-------------------|
| Purchase Costs Allocated to DM-X |     | \$64,711.11       |
| DM-X Purchase Orders             | 400 | 400               |
| DM-X Purchase Order Rate         |     | <u>\$161.7778</u> |
|                                  |     |                   |
| Purchase Costs Allocated to DM-Y |     | \$202,222.22      |
| DM-X Purchase Orders             |     | 500               |
| DM-X Purchase Order Rate         |     | <u>\$404.4444</u> |

Manufacturing costs per unit for P-A and P-B.

| Product Costing Per ABC -Total Calculation |                 |         | P-A              | 20,000          | P-B             | 20,000          |
|--|-----------------|---------|------------------|-----------------|-----------------|-----------------|
| DM-X                                       |                 |         | \$540,000        |                 | \$540,000       |                 |
| DM-Y                                       |                 |         | \$0              | \$540,000       | \$2,250,000     | \$2,790,000     |
| DL-D1                                      |                 |         | <u>\$600,000</u> |                 | <u>\$72,000</u> |                 |
| DL-D2                                      |                 |         | \$180,000        | \$780,000       | \$216,000       | \$288,000       |
| Total Direct Costs                         |                 |         |                  | \$1,320,000     |                 | \$3,078,000     |
| MOH  | Allocation Rate | CAB Qty |                  |                 | CAB Qty         |                 |
| Indirect Labor                             |                 |         |                  |                 |                 |                 |
| Dept 1                                     | \$15.0000       | 15,400  | \$231,000.00     |                 | 25,400          | \$381,000.00    |
| Dept 2                                     | \$20.0000       | 12,800  | \$256,000.00     | \$487,000.00    | 18,800          | \$376,000.00    |
|  |                 |         |                  |                 |                 | \$757,000.00    |
| Machine Costs                              |                 |         |                  |                 |                 |                 |
| Dept 1                                     | \$27.2400       | 10,000  | \$272,400.00     |                 | 20,000          | \$544,800.00    |
| Dept 2                                     | \$49.4000       | 10,000  | \$494,000.00     | \$766,400.00    | 40,000          | \$1,976,000.00  |
|  |                 |         |                  |                 |                 | \$2,520,800.00  |
| Purchases                                  |                 |         |                  |                 |                 |                 |
| DM-X                                       | \$161.7778      | 160     | \$25,884.44      |                 | 160             | \$25,884.44     |
| DM-Y                                       | \$404.4444      | 0       | \$0.00           | \$25,884.44     | 1,000           | \$404,444.44    |
|  |                 |         |                  |                 |                 | \$430,328.89    |
| Total Allocated MOH                        |                 |         |                  | \$1,279,284.44  |                 | \$3,708,128.89  |
| Total product costs                        |                 |         |                  | \$2,599,284.44  |                 | \$6,786,128.89  |
| Number of units                            |                 |         |                  | 20,000          |                 | 20,000          |
| Cost per unit                              |                 |         |                  | <u>\$129.96</u> |                 | <u>\$339.31</u> |

| ABC -Unit Calculation | Rate    | CAB Qty | P-A           | CAB Qty | P-B             |
|-----------------------|---------|---------|---------------|---------|-----------------|
| DM-X                  | \$6.75  | 4       | \$27.00       | 4       | \$27.00         |
| DM-Y                  | \$11.25 | 0       | \$27.00       | 10      | <u>\$112.50</u> |
| DL-D1                 | \$12.00 | 2.5     | \$30.00       | 0.3     | \$3.60          |
| DL-D2                 | \$18.00 | 0.5     | <u>\$9.00</u> | 0.6     | \$10.80         |
| Total Direct Costs    |         |         | \$66.00       |         | <u>\$153.90</u> |

| Allocated MOH       |         |      |                |                 |       |                |                 |
|---------------------|---------|------|----------------|-----------------|-------|----------------|-----------------|
| IDL-D1 (IDLHs CAB)  | \$15.00 | 0.77 | \$11.55        |                 | 1.27  | \$19.05        |                 |
| IDL-D2 (IDLHs CAB)  | \$20.00 | 0.64 | <u>\$12.80</u> | \$24.35         | 0.94  | \$18.80        | \$37.85         |
| MH-D1 (MHs CAB)     | \$27.24 | 0.50 | \$13.62        |                 | 1.00  | \$27.24        |                 |
| MH-D2 (MHs CAB)     | \$49.40 | 0.50 | <u>\$24.70</u> | \$38.32         | 2.00  | <u>\$98.80</u> | \$126.04        |
| Purchasing-DM-X     | \$0.32  | 4.00 | \$1.29         |                 | 4.00  | \$1.29         |                 |
| Purchasing-DM-Y     | \$2.02  | 0    | <u>\$0.00</u>  | \$1.29          | 10.00 | <u>\$20.22</u> | \$21.52         |
| Total Allocated MOH |         |      |                | <u>\$63.96</u>  |       |                | <u>\$185.41</u> |
| Total Unit Cost     |         |      |                | <u>\$129.96</u> |       |                | <u>\$339.31</u> |

Below is a comparison of the calculated products costs including occupancy costs (ABC-GAAP) and excluding them (ABC- non GAAP). There is the obvious reduction in costs by excluding occupancy costs, but the more important issue is how much does that reduce distortion in the calculated product costs. Including occupancy costs results in a product cost profile whereby P-A costs 36.79% of P-B. Excluding occupancy costs changes this product cost profile to P-A costing 38.30% of P-B. Therefore we can conclude that the impact of including an arbitrary allocation of a facility sustaining cost – occupancy- has a very slightly distorting effect of P-A subsidizing P-B.

Another interesting observation regards the under/over allocation of MOH. As seen in the table below, the non GAAP ABC model significantly reduces the amount of over-allocated MOH by approximately \$340,000. This is logical because the occupancy costs were 25% of total MOH and these costs were allocated based on MHs which were in excess of budgeted MHs.

| Unit Product Costs | P-A      | P-B      | (Under)/Over Allocated MOH |
|--------------------|----------|----------|----------------------------|
| ABC- GAAP          | \$151.94 | \$412.96 | \$675,111.21               |
| ABC non GAAP       | \$129.96 | \$339.31 | \$332,613.33               |

## PART F

39. Comment on the potential strategic consequences for P-A and P-B resulting from the use of an inaccurate product costing system.

The following table summarizes the changes in product costs as MMI has evolved its costing system from an actual plant-wide MOH rate to an ABC model.

| Unit Product Costs   |        | P-A      | P-B      | (Under)/Over Allocated MOH | P-A cost/P-B Cost |
|----------------------|--------|----------|----------|----------------------------|-------------------|
| Actual plant-wide    | PART A | \$305.42 | \$225.72 | none                       | 135.30%           |
| Normal plant-wide    | PART B | \$66.00  | \$153.90 | (\$3,726,079)              | 42.88%            |
| Normal dept - direct | PART C | \$163.64 | \$340.80 | (\$534,009.06)             | 48.02%            |

|                         |        |          |          |                |        |
|-------------------------|--------|----------|----------|----------------|--------|
| Normal dept - step-down | PART C | \$117.84 | \$160.12 | (\$515,280.84) | 73.60% |
| ABC -ABM                | PART D | \$151.94 | \$412.96 | \$675,111.21   | 36.79% |
| ABC- costing            | PART E | \$151.94 | \$412.96 | \$675,111.21   | 36.79% |
| ABC non GAAP            | PART E | \$129.96 | \$339.31 | \$332,613.33   | 38.30% |

There was initially a very significant subsidization of P-B by P-A, grossly overstating P-A and understating P-B's costs. Comparing the actual plant-wide costs with the normal plant-wide costs reveals that a significant amount of under- utilized capacity was absorbed by both products, particularly P-A since MOH was allocated by DLHs and P-A was labor intensive relative to P-B.

The movement to departmental MOH rates significantly reduced the amount of product subsidization of P-B by P-A. This was further reduced by the adoption of the ABC system. The movement from the actual plant-wide system to the ABC almost completely reverses the product cost profiles for P-A and P-B.

This mis-costing has significant strategic consequences given prices are marked up from calculated costs. P-A is a commodity which competes on price. The over-costing of P-A would lead to an over-pricing of P-A which would lead to a loss of market share which explains why actual sales of P-A are 50% of budgeted sales. As seen in the table below, the markup for P-A is 54.77% of the sales price marked up using actual VBC and 31.04% of the sales price marked up using normal VBC, far above the intended 10% markup.

P-B is a differentiated product and therefore has more pricing power. However since it was under-costed it would be under-priced. This explains why the actual sales of P-B are double the budgeted sales. As seen below, whether utilizing the original prices based on either the actual sales mix or the budgeted sales mix, P-B does not recover its product costs and sells at a loss.

|              | P-A        |        | P-B        |
|--------------|------------|--------|------------|
| Sales Price  | \$335.96   |        | \$293.44   |
| Direct Costs | (\$66.00)  |        | (\$153.90) |
| MOH          |            |        |            |
| ABC          | (\$85.94)  |        | (\$259.06) |
| Total Costs  | (\$151.94) |        | (\$412.96) |
| Gross Profit | \$184.02   | 54.77% | (\$119.51) |

|              | P-A        |        | P-B        |
|--------------|------------|--------|------------|
| Sales Price  | \$220.32   |        | \$252.44   |
| Direct Costs | (\$66.00)  |        | (\$153.90) |
| MOH          |            |        |            |
| ABC          | (\$85.94)  |        | (\$259.06) |
| Total Costs  | (\$151.94) |        | (\$412.96) |
| Gross Profit | \$68.38    | 31.04% | (\$160.51) |



