Baker Engineering Assignment
BUSA 323[1]

Context: Baker Engineering operates a single manufacturing facility in which it produces two products: A and B. Demand for product A is booming; Baker is considering increasing production in order to satisfy the surge in demand. Product B seems to be a dud; it is not moving, despite what appear to be give-away prices. Baker's management is puzzled about this turn of events.

Baker's manufacturing operations require three service departments [computer services, personnel, and janitorial services] and two production departments [foundry and assembly]. The computer services department provides data processing support to personnel [think payroll] and foundry and assembly [production scheduling, programming and tech support for computer-controlled machinery, etc.]. The personnel folks handle hiring and related personnel matters. The janitorial services department keeps the place clean. In the foundry [think hot, dirty, dangerous], molten metal is poured into molds to create castings, which are then machined to appropriate tolerances. Foundry operations are complex and require substantial capital assets and skilled workers. In the assembly department, various components [some from casting, others purchased from vendors] are assembled. Assembly operations are labor intensive, but require little skill and require simple tools that can be purchased at a hardware store.

Numerical data [costs, labor and material requirements, etc.] are included in the attached printouts from my Excel model.

Purpose: The Baker Engineering assignment provides the foundation for the entire topic of cost allocation and cost accounting systems. In other words, the material covered here is central to much of what we will do this semester. I have taught this material for over 25 years. By far the most common problem students experience with this material that they shortchange the time they spend on this relatively simple illustration. It will be tempting to look over the Excel printouts attached and assume that you "know" how to do the allocations. However, I believe it is essential that you set up the Excel model yourself and develop the formulas necessary to reproduce the numbers I have given you [*yes, every single cell*].

Having done that, you should be able to tell me [or someone else] precisely what each cell represents? An allocation ratio or rate? An allocated cost? The results of an allocation? You need to be able to explain why the results you get are different with different allocation assumptions. [Something like "the cost changed because the allocations changed" is true, but begs the question. WHY do the cost change? What is going on? What is happening to assumptions about resource consumption?]

Some of you may argue that this is stupid. "We have the numbers. Why waste time rebuilding the model?" Answer: Because reading about it and looking at it is not the same as doing it. When students have trouble with this material, I invariably ask "Have you set up Baker Engineering?" The responses vary, but can diplomatically be summarized as "Well, sort of." The consequences

[always negative] are predictable with a probability of 100%. The procedure is not difficult, but it does require developing a systematic understanding of the steps in process, where the numbers come from and what they mean.

What is attached: The attached pages are direct printouts of my Excel model for this problem. Note that there are nine pages attached. The pages are numbered and I have included worksheet names at the top of the respective pages:

Page 1: This is my *data* worksheet. ALL the "raw data" are entered here. There are ***no data values*** entered anywhere else in the entire Excel model. Even here, any dependent values [e.g., column and row totals] are derived with cell formulas.

Page 2: This is the data worksheet, color coded so that you can see where the VALUES are entered. EVERY other calculated cell in the entire model is cell referenced to these or to other cell formulas.

Page 3: This is the model for the direct allocation.

Page 4: This is the model for the step-down allocation.

Page 5, 6, and 7: This worksheet replicates the product cost calculations under the various assumptions of labor and overhead costing. These are printouts of the SAME worksheet. Page 5 is the costs under the plantwide rate. Page 6 uses the direct allocation, and page 7 uses the step allocation. Note the importance of using cell B2 as a driver for the =IF( ) functions in the worksheet. DO NOT create three separate worksheets. Use the =IF( ) function to test the alternative models.

Page 8: Page 8 calculates the net income under the various product costing assumptions. Note that the net income is always the same, but that the relative profitability of the products changes as the allocations change. Note that cell B2 [formatted to span B2:D2] is cell referenced to the "model number" cell in the "costs" worksheet. Note that I have included the income worksheet for ***just the plantwide rate assumptions***. As with the product cost worksheet, DO NOT create separate worksheets. Use =IF( ) functions.

Page 9: This is what I call the "proof" worksheet. Remember that product costing is a "wash." All the costs that we start with have to wind up somewhere, either in inventory or in cost of goods sold. The total at the end has to be the same as the total at the beginning. If the totals are different [except for small rounding errors], something is wrong somewhere. Note also that as long as there is no inventory to worry about [with consequent issues like FIFO and LIFO], changing from one cost accounting model to another will have not have an impact on **total** cost of goods sold or **total** net income. The relative profitability of products will change, however. Remember that we're just rearranging those beans under the coconut shells.

[Note that we are dealing exclusively with absorption costing here. A change from absorption to variable costing [or vice versa] WILL have an impact on profitability IF there are changes in inventory.]

	A	B	C	D	E	F	G	H
1	**Baker Engineering Problem: Cost Allocation and Product costing**							
2					**Production Departments**			
3		**Computer**	**Personnel**	**Janitor**	**Foundry**	**Assembly**	**Totals**	
4	**Labor costs**	$95,000	$60,000	$22,000	$468,000	$580,000	$1,225,000	
5	**Material costs**	12,000	5,000	1,000	169,600	109,600	$297,200	
6	**Overhead costs**	40,000	10,000	3,000	172,000	50,000	$275,000	
7	**Total overhead**	$147,000	$75,000	$26,000	$172,000	$50,000	$470,000	
8	**Total costs**	$147,000	$75,000	$26,000	$809,600	$739,600	$1,797,200	
9	**Computer hours budgeted**	1,500	100	0	1,800	100	3,500	
10	**Number of employees**	6	9	3	15	21	54	
11	**Square feet occupied**	1,000	2,000	500	10,000	5,000	18,500	
12	**Direct labor hours budgeted**	8,320	14,560	6,240	31,200	58,000	118,320	
13	**Product A material**				$ 80.00	$ 20.00	$ 100.00	
14	**Product A production**				1,000	1,000		
15	**Product A DLH**				20	2		
16	**Product A Total DLH**				20,000	2,000		
17	**Product B material**				$ 40.00	$ 40.00	$ 80.00	
18	**Product B produciton**				2,240	2,240		
19	**Product B DLH**				5	25		
20	**Product B Total DLH**				11,200	56,000		
21	**Wage rate/DLH**				$ 15.00	$ 10.00		
22	**Total DLH required**				31,200	58,000	89,200	
23		**Product A**	**Product B**					
24	**Sales price**	$ 670.00	$ 625.00				**go to**	
25	**Non-Manufacturing costs**	$ 20.00	$ 25.00				plantwide rate	
26	**Color coding > > > >**	**Overhead Costs**	**Allocation Bases for the production departments**				direct allocation	
27		**Product A data**	**Propduct B data**				step down allocation	
28							product cost calculations	
29	**Plantwide rate**						income statements	
30	**Total overhead**	$470,000					proof	
31	**Total production DLH**	89,200						
32	**Overhead rate/DLH**	$5.26905830						

All the decimals in cell B34 are merely to show that this does NOT come out even.

	A	B	C	D	E	F	G	H
1	**Baker Engineering Problem**							
2	**Cost Allocation and Product Costing**							
3		**Service Departments**			**Production Departments**			
4		**Computer**	**Personnel**	**Janitor**	**Foundry**	**Assembly**	**Totals**	
5	**Labor costs**	**$95,000**	**$60,000**	**$22,000**	**$468,000**	**$580,000**	**$1,225,000**	
6	**Material costs**	**12,000**	**5,000**	**1,000**	**169,600**	**109,600**	**$297,200**	
7	**Overhead costs**	**40,000**	**10,000**	**3,000**	**172,000**	**50,000**	**$275,000**	
8	**Total overhead**	**$147,000**	**$75,000**	**$26,000**	**$172,000**	**$50,000**	**$470,000**	
9	**Total costs**	**$147,000**	**$75,000**	**$26,000**	**$809,600**	**$739,600**	**$1,797,200**	
10	**Computer hours budgeted**	**1,500**	**100**	**0**	**1,800**	**100**	**3,500**	
11	**Number of employees**	**6**	**9**	**3**	**15**	**21**	**54**	
12	**Square feet occupied**	**1,000**	**2,000**	**500**	**10,000**	**5,000**	**18,500**	
13	**Direct labor hours budgeted**	**8,320**	**14,560**	**6,240**	**31,200**	**58,000**	**118,320**	
14	**Product A material**				**$ 80.00**	**$ 20.00**	**$ 100.00**	
15	**Product A production**				**1,000**	**1,000**		
16	**Product A DLH**				**20**	**2**		
17	**Product A Total DLH**				**20,000**	**2,000**		
18	**Product B material**				**$ 40.00**	**$ 40.00**	**$ 80.00**	
19	**Product B produciton**				**2,240**	**2,240**		
20	**Product B DLH**				**5**	**25**		
21	**Product B Total DLH**				**11,200**	**56,000**		
22	**Wage rate/DLH**				**$ 15.00**	**$ 10.00**		
23	**Total DLH required**				**31,200**	**58,000**	**89,200**	
24		**Product A**	**Product B**					
25	**Sales price**	**$ 670.00**	**$ 625.00**					
26	**Non-Manufacturing costs**	**$ 20.00**	**$ 25.00**					
27								
28	**This sheet is included so you can see where I have used values in the original data worksheet.**							
29	**All of the cells shaded in blue are entered as values. All other cells are cell formulas based on cell references.**							

Page 3; Baker Engineering: **Direct** worksheet

	A	B	C	D	E	F	G
1	**Direct method: resource usage**						
2		**Computer**	**Personnel**	**Janitor**	**Foundry**	**Assembly**	**Totals**
3	**Computer hours used**	**1,500**	**100**	**-**	**1,800**	**100**	**1,900**
4	**Number of employees**	**6**	**9**	**3**	**15**	**21**	**36**
5	**Square feet occupied**	**1,000**	**2,000**	**500**	**10,000**	**5,000**	**15,000**
6	**Direct labor hours budgeted**	**8,320**	**14,560**	**6,240**	**31,200**	**58,000**	**89,200**
7	**Direct method: ratios**						
8		**Computer**	**Personnel**	**Janitor**	**Foundry**	**Assembly**	**Totals**
9	**Computer hour ratios**				**94.74%**	**5.26%**	**1.00**
10	**Employee ratios**				**41.67%**	**58.33%**	**1.00**
11	**Square foot ratios**				**66.67%**	**33.33%**	**1.00**
12	**Direct method: allocation table**						
13		**Computer**	**Personnel**	**Janitor**	**Foundry**	**Assembly**	**Totals**
14	**Total costs**	**$147,000**	**$75,000**	**$26,000**	**$172,000**	**$50,000**	**$470,000**
15	**Computer services**	**($147,000)**			**139,263**	**7,737**	**147,000**
16	**Personnel**		**($75,000)**		**31,250**	**43,750**	**75,000**
17	**Janitorial services**			**($26,000)**	**17,333**	**8,667**	**26,000**
18	**Total costs**	**$0**	**$0**	**$0**	**$359,846**	**$110,154**	**$470,000**
19	**Direct labor hours**				**31,200**	**58,000**	
20	**Departmental rates**				**$11.53354**	**$1.89920**	

	A	B	C	D	E	F	G
1	**Step-down method: resource usage**						
2	**Department**	**Computer**	**Personnel**	**Janitor**	**Foundry**	**Assembly**	**Totals**
3	**Computer hours**	**0**	**100**	**0**	**1,800**	**100**	**2,000**
4	**Employees**	**0**	**0**	**3**	**15**	**21**	**39**
5	**Square feet**	**0**	**0**	**0**	**10,000**	**5,000**	**15,000**
6	**Direct labor hours**				**31,200**	**58,000**	**89,200**
7	**Step-down method: ratios**						
8	**Computer hours**	**0.00%**	**5.00%**	**0.00%**	**90.00%**	**5.00%**	**100.00%**
9	**Employees**	**0.00%**	**0.00%**	**7.69%**	**38.46%**	**53.85%**	**100.00%**
10	**Square feet**	**0.00%**	**0.00%**	**0.00%**	**66.67%**	**33.33%**	**100.00%**
11	**Direct labor hours**	**0.00%**	**0.00%**	**0.00%**	**34.98%**	**65.02%**	**100.00%**
12	**Step-down method: cost allocation table**						
13		**Computer**	**Personnel**	**Janitor**	**Foundry**	**Assembly**	**Totals**
14	**Total costs**	**$147,000**	**$75,000**	**$26,000**	**$172,000**	**$50,000**	**$470,000**
15	**Allocate computer services**	**(147,000)**	**7,350**	**0**	**132,300**	**7,350**	**0**
16	**New total costs**	**0**	**82,350**	**26,000**	**304,300**	**57,350**	**470,000**
17	**Allocate personnel**		**(82,350)**	**6,335**	**31,673**	**44,342**	**0**
18	**New total costs**	**0**	**0**	**32,335**	**335,973**	**101,692**	**470,000**
19	**Allocate janitorial services**			**(32,335)**	**21,556**	**10,778**	**0**
20	**New total costs**	**0**	**0**	**0**	**357,529**	**112,471**	**470,000**
21	**Direct labor hours**				**31,200**	**58,000**	**89,200**
22	**Departmental rates**				**$11.46**	**$1.94**	

Page 5; Baker Engineering: **Costs** worksheet; note that changing Cell B2 drives changes in the unit costs of the 2 products. Cells F9:H9 demonstrate the calculations needed to derive the value in B8.

	A	B	C	D	E	F	G	H	I	J	K	L
1	**Product cost calculations**									Go to Power Point show		
2	**Cost model > >**	**1**	**Plantwide Rate**									
3	**Key:**	**1**	**Plant wide**							go to		
4		**2**	**Direct**							plantwide rate		
5		**3**	**Step down**							direct allocation		
6	**Overhead in Product A and B**									step down allocation		
7		**Foundry overhead**	**Assembly overhead**	**Total overhead**		**Calculation demonstrated**				product cost calculations		
8	**Product A**	**$ 105.38**	**$ 10.54**	**$ 115.92**		**Rate**	**Hours**	**Total ohd**		income statements		
9	**Product B**	**$ 26.35**	**$ 131.73**	**$ 158.07**	**$ 5.27**	**$ 5.27**	**20**	**$ 105.38**		proof		
10	**Cost of Products A and B**											
11			**Catsting labor**	**Assembly labor**	**Total overhead**	**Total mfg. cost/unit**	**Units**	**Extension**				
12	**Product A**	**$ 100.00**	**$ 300.00**	**$ 20.00**	**$ 115.92**	**$ 535.92**	**1,000**	**$ 535,919.28**		material is a lump sum (given)		
13	**Product B**	**80.00**	**75.00**	**250.00**	**$ 158.07**	**$ 563.07**	**2,240**	**$1,261,280.72**		labor is wage rate * hours		
14							**Total**	**$1,797,200.00**				
15	**Profitability of A and B**											
16		**Sales price**	**Production cost**	**Gross profit/unit**	**Non-mfg cost/unit**	**Profit/unit**	**Return on sales**	**With the plantwide rates, product B is going gangbusters.**				
17	**Product A**	**$ 670.00**	**$ 535.92**	**$ 134.08**	**$ 20.00**	**$ 114.08**	**17.03%**					
18	**Product B**	**$ 625.00**	**$ 563.07**	**$ 61.93**	**$ 25.00**	**$ 36.93**	**5.91%**					
19	**Note: The cells shaded in gray have =IF( ) functions which are driven by cell B2**											

Page 6; Baker Engineering: **Costs** worksheet; note that changing Cell B2 drives changes in the unit costs of the 2 products. Cells F9:H9 demonstrate the calculations needed to derive the value in B8.

	A	B	C	D	E	F	G	H	I	J	K	L
1	**Product cost calculations**									Go to Power Point show		
2	**Cost model > >**	**2**	**Direct Method**									
3	**Key:**	**1**	**Plant wide**							go to		
4		**2**	**Direct**							plantwide rate		
5		**3**	**Step down**							direct allocation		
6	**Overhead in Product A and B**									step down allocation		
7		**Foundry overhead**	**Assembly overhead**	**Total overhead**		**Calculation demonstrated**				product cost calculations		
8	**Product A**	**$ 230.67**	**$ 3.80**	**$ 234.47**		**Rate**	**Hours**	**Total ohd**		income statements		
9	**Product B**	**$ 57.67**	**$ 47.48**	**$ 105.15**	**$ 11.53**	**$ 11.53**	**20**	**$ 230.67**		proof		
10	**Cost of Products A and B**											
11			**Catsting labor**	**Assembly labor**	**Total overhead**	**Total mfg. cost/unit**	**Units**	**Extension**				
12	**Product A**	**$ 100.00**	**$ 300.00**	**$ 20.00**	**$ 234.47**	**$ 654.47**	**1,000**	**$ 654,469.22**		material is a lump sum (given)		
13	**Product B**	**80.00**	**75.00**	**250.00**	**$ 105.15**	**$ 510.15**	**2,240**	**$1,142,730.78**		labor is wage rate * hours		
14							**Total**	**$1,797,200.00**				
15	**Profitability of A and B**											
16		**Sales price**	**Production cost**	**Gross profit/unit**	**Non-mfg cost/unit**	**Profit/unit**	**Return on sales**	However, with the departmental rates, we get a radically different picture.				
17	**Product A**	**$ 670.00**	**$ 654.47**	**$ 15.53**	**$ 20.00**	**$ (4.47)**	**-0.67%**					
18	**Product B**	**$ 625.00**	**$ 510.15**	**$ 114.85**	**$ 25.00**	**$ 89.85**	**14.38%**					
19	**Note: The cells shaded in gray have =IF( ) functions which are driven by cell B2**											

Page 7: Baker Engineering: **Costs** worksheet; note that changing Cell B2 drives changes in the unit costs of the 2 products. Cells F9:H9 demonstrate the calculations needed to derive the value in B8.

	A	B	C	D	E	F	G	H	I	J	K	L
1	**Product cost calculations**									Go to Power Point show		
2	**Cost model > >**	**3**	**Step Down Method**									
3	**Key:**	**1**	**Plant wide**							go to		
4		**2**	**Direct**							plantwide rate		
5		**3**	**Step down**							direct allocation		
6	**Overhead in Product A and B**									step down allocation		
7		**Foundry overhead**	**Assembly overhead**	**Total overhead**		**Calculation demonstrated**				product cost calculations		
8	**Product A**	**$ 229.19**	**$ 3.88**	**$ 233.06**		**Rate**	**Hours**	**Total ohd**		income statements		
9	**Product B**	**$ 57.30**	**$ 48.48**	**$ 105.78**	**$ 11.46**	**$ 11.46**	**20**	**$ 229.19**		proof		
10	**Cost of Products A and B**											
11			**Catsting labor**	**Assembly labor**	**Total overhead**	**Total mfg. cost/unit**	**Units**	**Extension**				
12	**Product A**	**$ 100.00**	**$ 300.00**	**$ 20.00**	**$ 233.06**	**$ 653.06**	**1,000**	**$ 653,063.86**		material is a lump sum (given)		
13	**Product B**	**80.00**	**75.00**	**250.00**	**$ 105.78**	**$ 510.78**	**2,240**	**$1,144,136.14**		labor is wage rate * hours		
14							**Total**	**$1,797,200.00**				
15	**Profitability of A and B**											
16		**Sales price**	**Production cost**	**Gross profit/unit**	**Non-mfg cost/unit**	**Profit/unit**	**Return on sales**	**The differences between the direct and step down methods are insignificant. Why?**				
17	**Product A**	**$ 670.00**	**$ 653.06**	**$ 16.94**	**$ 20.00**	**$ (3.06)**	**-0.46%**					
18	**Product B**	**$ 625.00**	**$ 510.78**	**$ 114.22**	**$ 25.00**	**$ 89.22**	**14.28%**					
19	**Note: The cells shaded in gray have =IF( ) functions which are driven by cell B2**											

Page 8; Baker Engineering: **Income** worksheet--Income statements under the various assumptions. Cell B2 is =costs!B2 so that linkage of the appropriate cost model is assured.

	A	B	C	D	E	F
1	**Baker Engineering Income Statement**					
2	**Model > > > >**	**1**				
3		**Product A**	**Product B**	**Total**	**go to**	
4	**Units**	**1,000**	**2,240**		**plantwide rate**	
5	**Sales price**	**$ 670.00**	**$ 625.00**		**direct allocation**	
6	**Revenue**	**$ 670,000**	**$ 1,400,000**	**$ 2,070,000**	**step down allocation**	
7	**Cost of goods sold**	**535,919**	**1,261,281**	**$ 1,797,200**	**product cost calculations**	
8	**Gross margin**	**$ 134,081**	**$ 138,719**	**$ 272,800**	**income statements**	
9	**Non-mfg costs**	**20,000**	**56,000**	**$ 76,000**	**proof**	
10	**Net income**	**$ 114,081**	**$ 82,719**	**$ 196,800**		
11	**Return on sales**	**17.03%**	**5.91%**	**9.51%**		Go to Power Point sl

Page 9; Baker Engineering: **Proof** worksheet; Thius shows that total costs are always the same as long as sales and production are the same under the variouos cost model assumptions.

	A	B	C	D	E	F	G
1	**Reconciliation of total overhead**						
2		**3**		**Direct**		**Stepdown**	
3	**Department**	**Foundry**	**Assembly**	**Foundry**	**Assembly**	**Foundry**	**Assembly**
4	**Overhead rate**	**$ 5.27**	**$ 5.27**	**$ 11.53**	**$ 1.90**	**$ 11.46**	**$ 1.94**
5	Product A hours	20	2	20	2	20	2
6	Product B units	1,000	1,000	1,000	1,000	1,000	1,000
7	Total costs	$ 105,381.17	$ 10,538.12	$ 230,670.83	$ 3,798.40	$ 229,185.57	$ 3,878.29
8	Product totals		$ 115,919.28		$ 234,469.22		$ 233,063.86
9	Product B hours	5	25	5	25	5	25
10	Product B units	2240	2240	2240	2240	2240	2240
11	Total costs	$ 59,013.45	$ 295,067.26	$ 129,175.66	$ 106,355.11	$ 128,343.92	$ 108,592.22
12	Product totals		$ 354,080.72		$ 235,530.78		$ 236,936.14
13	Total allocated costs		**$ 470,000**		**$ 470,000**		**$ 470,000**
14	Total costs to be allocated		**$ 470,000**		**$ 470,000**		**$ 470,000**
15	Difference (sh/be zero)		0		0		0