Lesson 16 Aggregate Planning Solutions

Solved Problem #1: See textbook

Solved Problem #2: See textbook

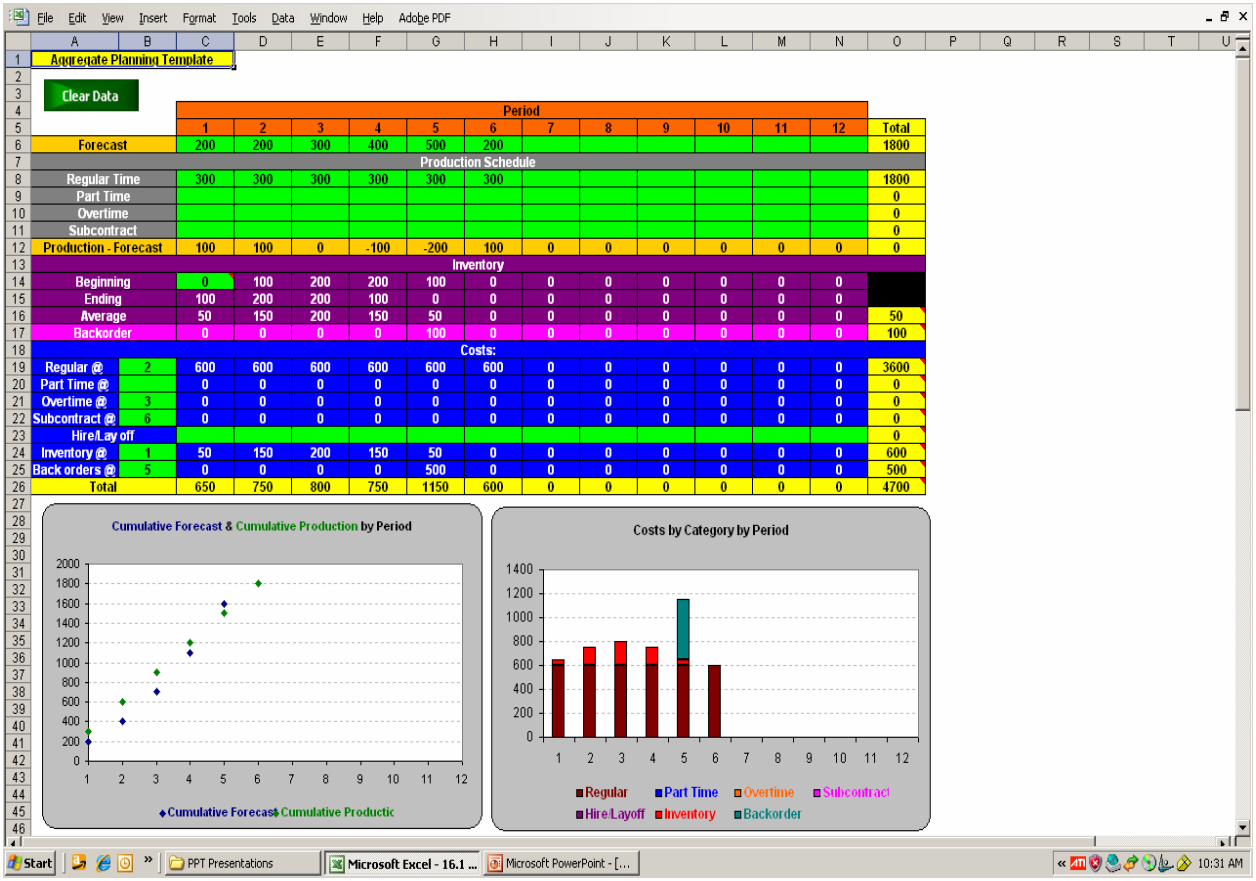
#1: Refer to Lesson Example 1: Planners for a company that makes several models of tractors are about to prepare an aggregate plan that will cover 6 periods. They have assembled the following cost information:

Output Costs
- Regular time 2 per tractor
- Overtime 3 per tractor
- Subcontract 6 per tractor

Inventory Costs
- 1 per tractor per period on average inventory

Backorder Costs
- 5 per tractor per period

As you recall, the level capacity plan using 300 tractors per period produced a plan which cost $4,700.



Also, we saw that the backorder quantity was 100 in period 5 with a cost of $500.

Management has discussed the backorder situation with the production staff and they have agreed that the backorders can be eliminated if they work overtime. The production staff is also aware if they work overtime in earlier months that they will be able to take some time off in a later month.

Use a maximum of 300 regular time production units, with an overtime strategy:

Develop a plan which will lower costs and eliminate the backorder problem. Show your plan in the following table. Note: you do not need to enter cells which have a value of 0.

		Period						
		1	2	3	4	5	6	Total
Forecast		200	200	300	400	500	200	1,800
Production Schedule								
Regular Time		300	300	300	300	300	200	1700
Part Time								
Overtime		25	25	25	25			100
Subcontract								
Production - Forecast		125	125	25	-75	-200		
Inventory								
Beginning			125	250	275	200		
Ending		125	250	275	200			
Average		62.5	187.5	262.5	237.5	100		
Backorder								
Costs:								
Regular @	2	600	600	600	600	600	400	3,400
Part Time @								
Overtime @	3	75	75	75	75			300
Subcontract @	6							
Hire/Lay off								
Inventory @	1	62.5	187.5	262.5	237.5	100		850
Back orders @	5							
Total		737.5	862.5	937.5	912.5	700	400	4,550

Explain the cost differences between the two plans.

Regular time costs went down $200 from $3,600 to $3,400
Overtime costs went up $300 from $0 to $300
Inventory costs went up $250 from $600 to $850
Backorder costs went down $500 from $500 to $0
Total costs went down $150 from $4,700 to $4,550

If you were one of the production staff, would you be happy with this plan?

Yes, while I had to work more overtime in the first 4 periods, I got to take time off in the 6th period. Looking at the impact to me, I worked the same amount of hours over the 6 periods and got paid $100 more than if I had worked the original schedule. Customers did not have to wait on their orders and the company cost was also $150 less, so it was a win-win proposition for everyone involved.

#2: Manager T.C. Downs of Plum Engines, a producer of lawn mowers and leaf blowers, must develop an aggregate plan for the engine department for the forecast shown below:

	1	2	3	4	5	6
Forecast	120	135	140	120	125	125

The department has a normal capacity of 130 engines per period. The costs are shown below:

Output Costs
- Regular time (normal output) $60 per engine
- Overtime $90 per engine

Inventory Costs
- $2 per engine per period on average inventory

Backorder Costs
- $90 per engine per period

Beginning inventory is 0 engines.

a. Develop a chase strategy using normal output and overtime. Show your plan in the following table. Note: you do not need to enter cells which have a value of 0.

		Period						
		1	2	3	4	5	6	Total
Forecast		120	135	140	120	125	125	765
Production Schedule								
Regular Time		120	130	130	120	125	125	750
Part Time								
Overtime			5	10				15
Subcontract								
Production - Forecast								
Inventory								
Beginning								
Ending								
Average								
Backorder								
Costs:								
Regular @	60	7,200	7,800	7,800	7,200	7,500	7,500	45,000
Part Time @								
Overtime @	90		450	900				1,350
Subcontract @								
Hire/Lay off								
Inventory @	2							
Back orders @	90							
Total		7,200	8,250	8,700	7,200	7,500	7,500	46,350

b. Develop a level capacity plan that uses inventory to absorb fluctuations. Show your plan in the following table. Note: you do not need to enter cells which have a value of 0. Note: half units are acceptable.

		Period						
		1	2	3	4	5	6	Total
Forecast		120	135	140	120	125	125	765
Production Schedule								
Regular Time		127.5	127.5	127.5	127.5	127.5	127.5	765
Part Time								
Overtime								
Subcontract								
Production - Forecast		7.5	-7.5	-12.5	5	2.5	2.5	
Inventory								
Beginning			7.5					
Ending		7.5						
Average		3.75	3.75					
Backorder				12.5	5	2.5		20
Costs:								
Regular @	60	7,650	7/650	7,650	7,650	7,650	7,650	45,900
Part Time @								
Overtime @	90							
Subcontract @								
Hire/Lay off								
Inventory @	2	7.5	7.5					15
Back orders @	90			1,125	450	225		1,800
Total		7,657.5	7,657.5	8,775	8,100	7,875	7,650	47,715

c. Compare the cost of the plan in a. and b.

Regular time cost is $900 higher in b. than in a.
Overtime time cost is $1,350 lower in b. than in a.
Inventory cost is $15 higher in b. than a.
Backorder cost is $1,800 higher in b. than in a.
Total cost for b. is $1,365 higher in b. than in a.

#3: Nowjuice, Inc. produces bottled pickled juice. A planner has developed an aggregate forecast for the demand (in cases) for the next six months as shown below:

	1	2	3	4	5	6
Forecast	4,000	4,800	5,600	7,200	6,400	5,000

The costs are shown below:

Output Costs
Regular time (normal output) $10 per case

Overtime $16 per case
Subcontracting $20 per case

Inventory Costs

$1 per case per month on average inventory

Beginning inventory is 0 cases, and regular production capacity is 5,000 cases per month. No backorders are allowed.

a. Develop an aggregate plan using a level regular production strategy, inventory and overtime. Show your plan in the following table. Note: you do not need to enter cells which have a value of 0.

		Period						
		1	2	3	4	5	6	Total
Forecast		4,000	4,800	5,600	7,200	6,400	5,000	33,000
Production Schedule								
Regular Time		5,000	5,000	5,000	5,000	5,000	5,000	30,000
Part Time								
Overtime					1,600	1,400		3,000
Subcontract								
Production - Forecast		1,000	200	-600	-600			
Inventory								
Beginning			1,000	1,200	600			
Ending		1,000	1,200	600				
Average		500	1,100	900	300			
Backorder								
Costs:								
Regular @	10	50,000	50,000	50,000	50,000	50,000	50,000	300,000
Part Time @								
Overtime @	16				25,600	22,400		48,000
Subcontract @	20							
Hire/Lay off								
Inventory @	1	500	1,100	900	300			2,800
Back orders @								
Total		50.500	51,100	50,900	75,900	72,400	50,000	350,800

b. Develop an aggregate plan using a combination of regular time, overtime (maximum of 500 cases per month), inventory, and subcontracting (maximum of 500 cases per month) to handle variations in demand. Show your plan in the following table. Note: you do not need to enter cells which have a value of 0. Note: half units are acceptable.

		Period						
		1	2	3	4	5	6	Total
Forecast		4,000	4,800	5,600	7,200	6,400	5,000	33,000
Production Schedule								
Regular Time		5,000	5,000	5,000	5,000	5,000	5,000	30,000
Part Time								
Overtime		500	500	500	500	500		2,500
Subcontract						500		500
Production - Forecast		1,500	700	-100	-1,700	-400		
Inventory								
Beginning			1,500	2,200	2,100	400		
Ending		1,500	2,200	2,100	400			
Average		750	1,850	2,150	1,250	200		
Backorder								
Costs:								
Regular @	10	50,000	50,000	50,000	50,000	50,000	50,000	300,000
Part Time @								
Overtime @	16	8,000	8,000	8,000	8,000	8,000		40,000
Subcontract @	20					10,000		10,000
Hire/Lay off								
Inventory @	1	750	1,850	2,150	1,250	200		6,200
Back orders @								
Total		58,750	59,850	60,150	59,250	50,000		356,200

c. Develop an aggregate plan using a combination of regular time, overtime (up to 750 cases per month), and inventory to handle variations in demand. Show your plan in the following table. Note: you do not need to enter cells which have a value of 0. Note: half units are acceptable.

		Period						
		1	2	3	4	5	6	Total
Forecast		4,000	4,800	5,600	7,200	6,400	5,000	33,000
Production Schedule								
Regular Time		5,000	5,000	5,000	5,000	5,000	5,000	30,000
Part Time								
Overtime			750	750	750	750		3,000
Subcontract								
Production - Forecast		1,000	950	150	-1,450	-650		
Inventory								
Beginning			1,000	1,950	2,100	650		
Ending		1,000	1,950	2,100	650			
Average		500	1,475	2,025	1,375	325		
Backorder								
Costs:								
Regular @	10	50,000	50,000	50,000	50,000	50,000	50,000	300,000
Part Time @								
Overtime @	16		12,000	12,000	12,000	12,000		48,000
Subcontract @	20							
Hire/Lay off								
Inventory @	1	500	1,475	2,025	1,375	325		5,700
Back orders @								
Total		50,500	63,475	64,025	63,375	62,325	50,000	353,700

#4: Refer to the Master Scheduling example in the lesson. The following table shows the Forecast, Customer Orders for a company:

	Planning Period							
	1	2	3	4	5	6	7	8
Forecast	30	30	30	30	40	40	40	40
Customer Orders	33	20	10	4	2			

a. What is the projected demand for the 8 planning periods? Complete the table below.

Projected Demand	33	30	30	30	40	40	40	40

b. Assuming the beginning inventory is 64 units, what is the projected on hand inventory? Complete the table below.

Projected On Hand	31	1	-29	-59	-99	-139	-179	-219

c. In the lesson, we used the MPS rule to order when the projected on hand was negative. Here, we wish to change the rule to order when the projected on hand inventory would be less than 10. Compute the MPS and show your result in the table below using the rule lot size is 70.

MPS		70			70	70		70

d. What is the available to promise (ATP) for the scenario in c.?

ATP	31	36			68	70		70

#5: The following table shows the Forecast, Customer Orders for a company:

	Planning Period							
	1	2	3	4	5	6	7	8
Forecast	30	30	30	30	40	40	40	40
Customer Orders	33	25	16	11	8	3		

Use the MPS rule to order when the projected on hand inventory is negative, and calculate the Projected Demand, Projected On Hand, MPS, and ATP by showing your answers in the table below. The beginning inventory is 40 units and the lot size is 50 units.

Projected Demand	33	30	30	30	40	40	40	40
Projected On Hand	7	27	47	17	27	37	47	7
MPS		50	50		50	50	50	
ATP	7	25	23		42	47	50	

#5: The following table shows the Forecast, Customer Orders for a company:

	Planning Period							
	1	2	3	4	5	6	7	8
Forecast	50	50	50	50	50	50	50	50
Customer Orders	52	35	20	12				

a. Use the MPS rule to order when the projected on hand inventory is negative, and calculate the Projected Demand, Projected On Hand, MPS, and ATP by showing your answers in the table below. The beginning inventory is 0 units and the lot size is 35 units.

Projected Demand	**52**	**50**	**50**	**50**	**50**	**50**	**50**	**50**
Projected On Hand	**18**	**3**	**23**	**8**	**28**	**13**	**33**	**18**
MPS	**70**	**35**	**70**	**35**	**70**	**35**	**70**	**35**
ATP	**18**		**50**	**23**	**70**	**35**	**70**	**35**

b. Use the MPS rule to order when the projected on hand inventory is negative, and calculate the Projected Demand, Projected On Hand, MPS, and ATP by showing your answers in the table below. The beginning inventory is 0 units and the maximum lot size is 35 units. Minimize the inventory on hand.

Projected Demand	**52**	**50**	**50**	**50**	**50**	**50**	**50**	**50**
Projected On Hand	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
MPS	**52**	**50**	**50**	**50**	**50**	**50**	**50**	**50**
ATP		**15**	**30**	**38**	**50**	**50**	**50**	**50**

c. Explain the difference between the two lot size rules. Lot size is 70 and maximum lot size is 70.

Lot size is 70 means that each time a lot is manufactured it must contain 70 units.

Maximum lot size of 70 means that lots under 70 are allowed; however, one must recognize that 70 is the most cost effective lot size and lots which do not contain 70 units will increase costs.

#6: Consider the following scenario: The forecast is 80 units for each of the first two periods and 60 units for the next three periods. The starting inventory is 20 units. Committed orders are 82, 80, 60, 40 and 20 for the first five periods, respectively.

The company uses a chase strategy for determining the MPS production lot size, except there is an upper limit on the lot size of 70 units. Also the desired safety stock of at least 10 units (i.e. inventory on hand can not drop below 10 units). The company always wants to an available to promise of at least 10 units.

Calculate the Projected Demand, Projected On Hand, MPS, and ATP by showing your answers in the table below.

	1	2	3	4	5	6	7	8
Forecast	80	80	60	60	60			
Customer Orders	82	80	60	40	20			
Projected Demand	82	80	60	60	60			
Projected On Hand	10	20	30	20	10			
MPS	72	90	70	50	50			
ATP	10	10	10	10	30			