Aggregate planning - examples

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Example 1

Example 1

A large distribution center must develop a staffing plan that minimizes the total cost using part-time workers. Use chase and level strategy and compute the total cost.

Inputs

Period	1	2	3	4	5	6
Forecasted demand (Number of part-time workers	6	12	18	15	13	14

- Each period is 20 hours.
- From the beginning manager has 10 part-time workers.
- The distribution center can hire new part-time workers in any period, but no more than 10.
- Overtime can not exceed 20 percent of the regular time (that is 4 hour) in any period.
- **The following costs can be assigned:**
  - **Regular time:** 2000 dollars per period (period = 20 hour).
  - **Overtime:** 150 percent of the regular time.
  - **Hires:** 1000 dollar per person.
  - **Layoffs:** 500 dollars per person.

Example 1: Chase strategy

Level strategy

Work undertime and overtime to keep workers.

Chase strategy

Hiring and laying off workers, depending on the demand.

Example 1: Chase strategy

Inputs

Period	1	2	3	4	5	6
Forecasted demand (Number of part-time workers	6	12	18	15	13	14

Actual data

Number of workers	6	12	18	15	13	14
Hires		6	6			1
Layoffs	4			3	2	

Costs

Salary	12000	24000	36000	30000	26000	28000
Hiring cost		6000	6000			1000
Layoff cost	2000			1500	1000	

Total cost	14000	30000	42000	31500	27000	29000	**$ 173 500,00**

The manager needs to layoff 4 workers, because she has 10 workers from start.

The manager needs to hire 6 workers, because she has 6 from the previous period.

Regular time: 2000 dollars per period(period = 20 hour).

Overtime: 150 percent of the regular time.

Hires: 1000 dollar per person.

Layoffs: 500 dollars per person.

Example 1: Level strategy

Level strategy

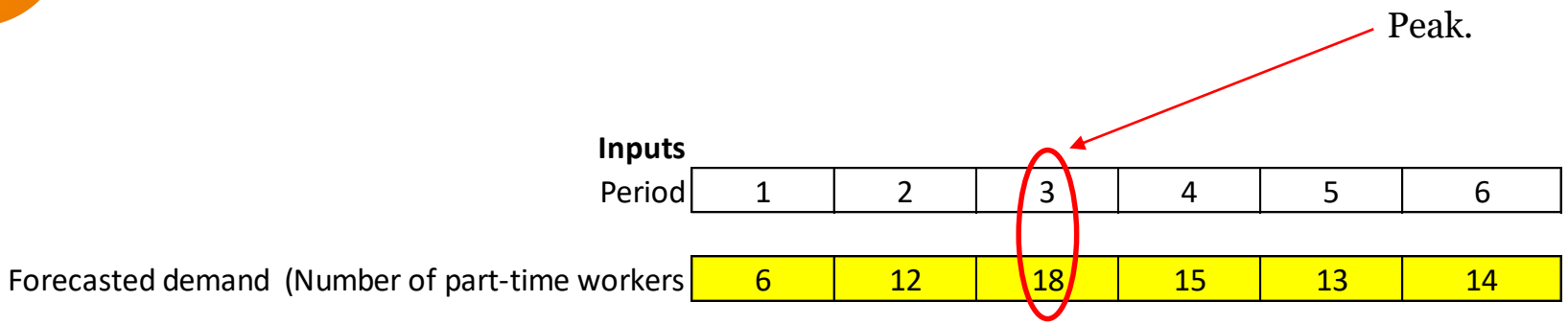
Work undertime and overtime to keep workers.

Chase strategy

Hiring and laying off workers, depending on the demand.

Type of costs:
Layoff cost and hiring cost

Example 1: Level strategy



- Each period is 20 hours.
- From the beginning manager has 10 part-time workers.
- She wants to minimize undertime in this level strategy.
- Maximize overtime in order to minimize undertime.
- Overtime can not exceed 20 percent of the regular time (that is 4 hour) in any period.
- The maximum use of overtime possible must occur in the peak period.

18/1,20 = 15

15 workers in all periods will maximize overtime and minimize undertime for this level strategy.

Example 1: Level strategy

Undertime is 3, because the manager has 15 workers and the demand is 12.

Overtime is 3, because the manager has 15 workers and the demand is 18.

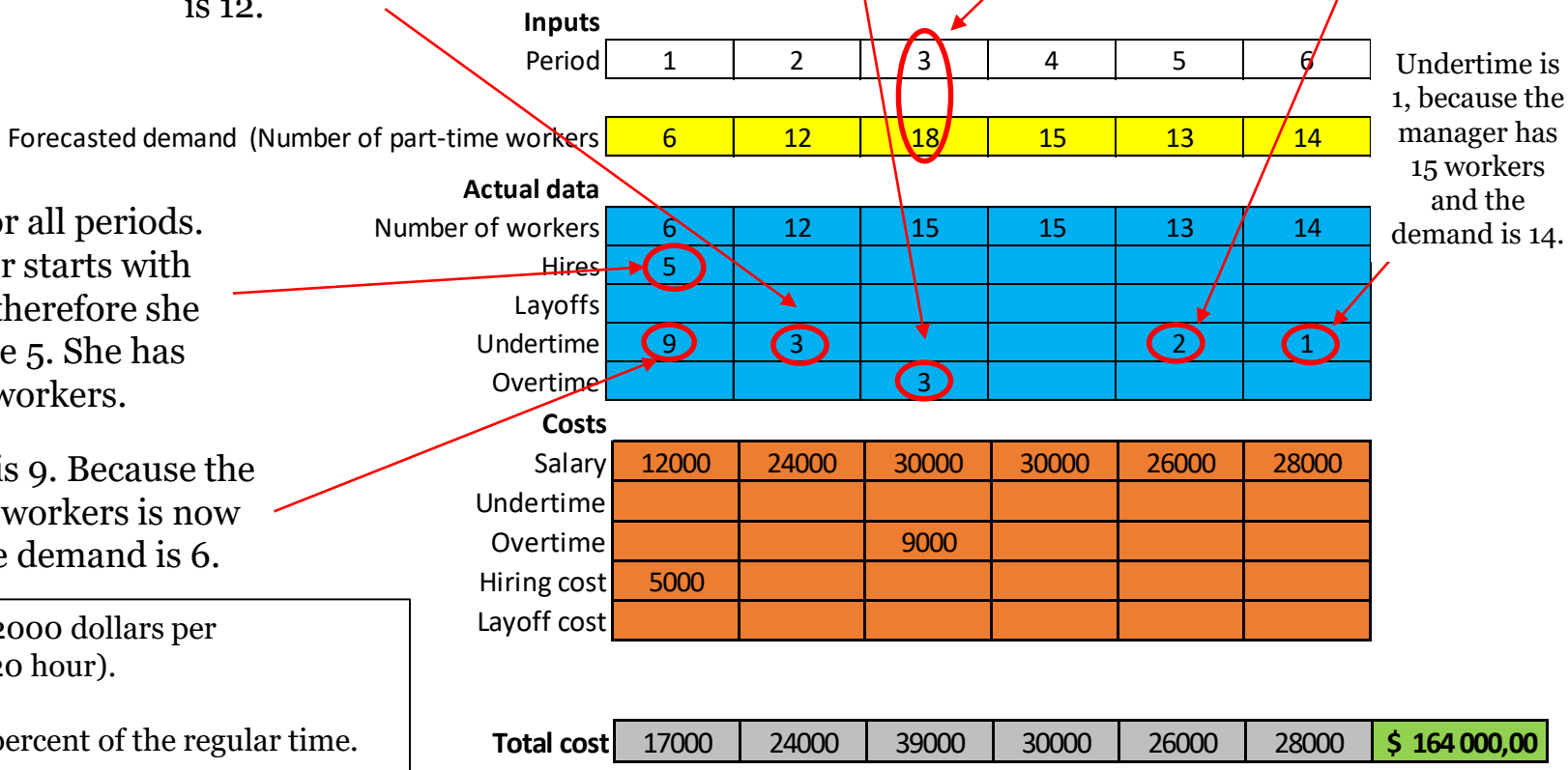
Undertime is 2, because the manager has 15 workers and the demand is 13.

Peak.

Undertime is 1, because the manager has 15 workers and the demand is 14.

15 workers for all periods. The manager starts with 10 workers, therefore she needs to hire 5. She has now 15 workers.

Undertime is 9. Because the number of workers is now 15 and the demand is 6.



Inputs						
Period	1	2	3	4	5	6
Forecasted demand (Number of part-time workers	6	12	18	15	13	14
Actual data						
Number of workers	6	12	15	15	13	14
Hires	5					
Layoffs						
Undertime	9	3			2	1
Overtime			3			
Costs						
Salary	12000	24000	30000	30000	26000	28000
Undertime						
Overtime			9000			
Hiring cost	5000					
Layoff cost						
Total cost	17000	24000	39000	30000	26000	28000

$ 164 000,00

Regular time: 2000 dollars per period(period = 20 hour).

Overtime: 150 percent of the regular time.

Hires: 1000 dollar per person.

Layoffs: 500 dollars per person.

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Example 2

Example 2

A General Motors Buick plant manufactures several Buick models.

Inputs

Quarter	1	2	3	4
Demand, number of cars	10000	12000	9000	11000

- The plant can produce 25 cars per quarter for each worker.
- Workers receive $15,000 per quarter.
- It costs $7,000 to hire and train a new worker and $10,000 to layoff a worker.
- GM has 480 workers on staff and 2000 cars in inventory from start.
- Any cars in inventory at the end of a quarter has a holding cost of $1,000.

Construct an aggregate plan for the next four quarters using the chase and level strategies and compute their total costs.

Example 2: Chase strategy

Level strategy

Work undertime and overtime to keep workers.

Chase strategy

Hiring and laying off workers, depending on the demand.

Example 2: Chase strategy

Inputs

Quarter	0	1	2	3	4
Demand, number of cars		10000	12000	9000	11000
Planned number of workers		400	480	360	440

Actual data

Production		8000	12000	9000	11000
Number of workers	480	320	480	360	440
Hires			160		80
Layoffs		160		120	
Inventory	2000				

25 cars per worker.
10000/25 = 400 workers.

480 workers and 2000 cars in inventory from start.

Costs

Salary	7200000	4800000	7200000	5400000	6600000
Hiring cost			1120000		560000
Layoff cost		1600000		1200000	
Inventory cost	2000000				

Total cost (Q1-Q4)	2000000	6400000	8320000	6600000	7160000	**$ 28 480 000,00**

Example 2: Level strategy

Level strategy

Work undertime and overtime to keep employees.

Types of costs:
Overtime cost and undertime cost

Chase strategy

Hiring and laying off employees, depending on the demand.

Type of costs:
Layoff cost and hiring cost

Example 2: Level strategy

Inputs

Quarter	1	2	3	4
Demand, number of cars	10000	12000	9000	11000

- Because GM has 2000 cars in inventory from start, we need to produce 8000 cars in period 1.

Quarter	0	1	2	3	4
Demand, number of cars	2000	8000	12000	9000	11000

- The company needs to manufacture 8000+12000+9000+11000 = 40 000 cars in quarter 1-4. 10 000 cars every quarter.

- We need 10000/25 = 400 workers to produce 10000 cars every quarter.

Example 2: Level strategy

Inputs

Quarter	0	1	2	3	4
Demand, number of cars		10000	12000	9000	11000
Planned number of workers		400	480	360	440

Actual data

Production		10000	10000	10000	10000
Number of workers	480	400	400	400	400
Hires			0		0
Layoffs		80		0	
Inventory	2000	2000	0	1000	0

Costs

Salary		6000000	6000000	6000000	6000000
Hiring cost			0		0
Layoff cost		800000		0	
Inventory cost	2000000	2000000	0	1000000	0

Total cost (Q1-Q4)	2000000	8800000	6000000	7000000	6000000	**$ 27 800 000,00**

480 workers from start.