MGT236, Examples sheet

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CHAPTER 2

The equations needed:

1. *Total productivity* = $\frac{useful\ output}{all\ inputs}$
2. *Partial productivity* = $\frac{useful\ output}{one\ input}$
3. *Multifactor productivity* = $\frac{useful\ output}{2\ or\ more\ inputs\ but\ not\ all\ inputs}$
4. *Percentage change in productivity* = $\frac{New\ productivity - old\ productivity}{Old\ productivity}$ *x 100*

2.1 For a certain product, the following data were available at the end of the last financial year:

Cost of materials	BD 105,000
Cost of labor	BD 175,000
Cost of energy	BD 85,000
Other costs	BD 15,000

If the number of units sold from this product is 28,000 at a selling price of BD 95 per unit, calculate the following:

a. The total productivity
b. The productivity of labor
c. The multifactor productivity of materials and energy.
d. If the total productivity the year before was 6.25, how much is the percentage change in the total productivity?

2.2 The Technical Garage employs 3 mechanics: A, B, and C to change cars' oil. Mechanic A can change the oil of 9 cars in 12 hours, mechanic B can change the oil of 5 cars in 4 hours, and mechanic C can change the oil of 7 cars in 5 hours. Which mechanic is more productive?

2.3 The production requirements of a certain product during one work shift are as follows:

The no. of units produced from this product is 300, the no. of workers used is 55, the length of the work shift is 12 hours, the wage rate per hour is BD 10, the raw material cost per unit produced of the output is BD 75, and the price per unit produced is BD 320.1. Find the multifactor productivity of materials and labor.

CHAPTER 3

The equations needed:

(The interpretation of the symbols used in the equations is given in page 3)

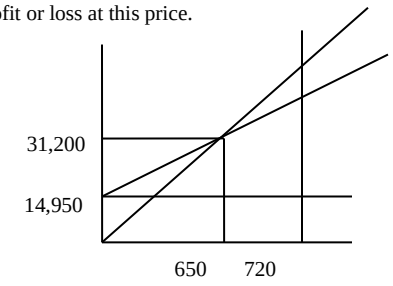
1. *The breakeven point (BEP) occurs when TR = TC*
2. *BEP* = $\frac{TFC}{P - AVC}$
3. *TR = P x Q*
4. *TC = TFC + TVC*
5. *ATC = TC ÷ Q*
6. *AFC =TFC ÷ Q*
7. *AVC = TVC ÷ Q*
8. π *=TR – TC*

3.1 The EASY- TECH Company is considering producing a new product. The expected total fixed costs of the new product are BD 41,600 and the average variable cost is BD 200.

a. If the selling price is BD 280 per unit, how many units of this product need to be produced and sold to breakeven?
b. Show the breakeven point graphically.
c. If the selling price per unit is BD 235, the company expects to sell 1,300 units. Calculate the profit or loss at this price.
d. In general, what would happen to the breakeven point if there is a decrease in the price?

3.2 From the given diagram find

a. breakeven point in units
b. value of the breakeven point in BD
c. total variable cost associated with Q = 720
d. profit or loss associated with the quantity of 720



CHAPTER 4

The equations needed:

(The interpretation of the symbols used in the equations is given in page 3)

The indifference point (Q) occurs when $TC_{make} = TC_{buy}$

Q can be obtained from the following equation:

$TFC_{make} + (AVC_{make} \times Q) = TFC_{buy} + (AVC_{buy} \times Q)$

Instead of 'make' we could say 'in-source' and instead of 'buy' we could say 'outsource'.

4.1 Currently, the NEW ERA Company is in-sourcing its main raw material with an annual total fixed costs of BD. 234,000 and an average variable cost of BD 22. However, if it decides to outsource this material the annual total fixed costs incurred will be BD 195,000 and the average variable cost will be BD 35.

a. Given the two alternatives (in-sourcing and outsourcing), determine the indifference point.

b. What would you recommend the company to do if the demand for the material next year is expected to be (i) 2,380 units, (ii) 3,400 units?

CHAPTER 12

The equations needed:

(The interpretation of the symbols used in the equations is given in page 3)

1. $ATI = t\,D \div 365$
2. $I_{turn} = CU \div I_{average}$
3. $ws = 52 \div I_{turn}$
4. $ws = I_{average} \div$ *weekly CU*
5. $ds = I_{average} \div$ *daily CU*

12.1 The XYZ Company has an annual demand of 32,850 units. The annual cost of goods sold is BD 8,640,480 and the average inventory is BD 720,040. Find the

a. average transportation inventory given that the company sends some of its finished goods from its factory to one of its distribution centers via road freight which takes 5 days transit.
b. inventory turnover
c. weeks of supply
d. days of supply, assuming that the company operates 260 days a year.,
e. annual holding costs of inventory if the capital cost, storage cost, and risk cost are 4%, 5%, and 1% per unit of inventory, respectively.

The equations of the EOQ model:

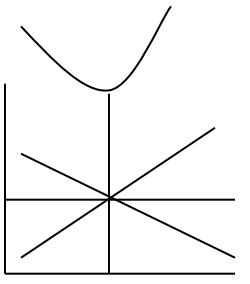
(The interpretation of the symbols used in the equations is given in page 3)

1. $Q = \sqrt{\frac{2DS}{H}}$
2. $TC =$ *Annual ordering costs + Annual holding costs* $= \frac{DS}{Q} + \frac{Q}{2} x\, H$
3. $N = \frac{D}{Q}$
4. $I_{average} = \frac{Q}{2}$
5. $I_{max} = Q$
6. $I_{min} = 0$
7. $R = d \times L$
8. $t_{cycle} = \frac{Q}{d}$

12.2 The cost per unit of a major material of a company is BD 120. The annual demand for this material is 38,000 units and the ordering cost is BD 142.5 per order. The annual holding cost is 10% of the cost per unit of the material, the lead time is 2 days and the company operates 250 days a year.

a. Find the EOQ, annual total costs of inventory, the time in days of the inventory cycle, the reorder pout, and the number of orders.
b. Show the cost and quantity curves of the EOQ model for this problem.

12.3 The given diagram shows the cost curves of the EOQ model. Answer the following questions assuming the ordering cost per order is BD 100.



a. For Q = 6,520, find the annual total costs of inventory and the annual holding cost per unit.

b. For Q = 7,200, find the annual holding costs and the annual ordering costs .

The equations of the EPQ model:

(The interpretation of the symbols used in the equations is given in page 3)

1. $Q = \sqrt{\frac{2DS}{H(1-\frac{d}{p})}}$
2. $Q = d_{run} + I_{max}$
3. $I_{max} = Q\,(1-\frac{d}{p})$
4. $P = Q \div t$
5. $d = d_{run} \div t$
6. $I_{build} = I_{max} \div t$
7. $P = d + I_{build}$
8. TC = Annual ordering costs + Annual holding costs
   $= \frac{DS}{Q} + \frac{I_{max}}{2} H$
9. $I_{average} = \frac{I_{max}}{2}$
10. $R = d \times L$
11. $N = \frac{D}{Q}$

12.4 The CBC Company has a yearly demand of 48,000 units of a certain material for their operations. The company has the capacity to produce 250 units from this material per day. The cost of setting up each production run is BD 179.56, the annual holding cost is BD 6 per unit of inventory and the company operates 320 days a year.

a. Calculate the EPQ, annual total costs of inventory, amount of material used to meet immediate demand during the production run, the number of production runs per year, the time or length of the production run in days, and the reorder point if the lead time is 3 days.

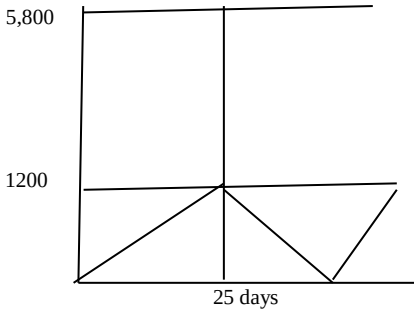
b. Show the curves of the EPQ model for this problem.

12.5 Refer to the given EPQ diagram to answer the following questions:

a. Find the EPQ, daily I_{build} , p, d_{run}, and R if the lead time is 2 days.

b. Suppose D, H, and S are the same for the EOQ and the EPQ models

Will the two models produce the same order quantity (Q)?



CHAPTER 16

16.1 The following data describe the activities of a small project.

a. Draw the project network and determine the possible paths in it.
b. Identify the critical path.
c. Find the completion time of the project.

Activity	:	S	T	W	U	V	Y
Immediate Predecessor	:	--	S	S	T, W	W	U, V
Activity time (or duration) in days	:	3	4	8	4	2	7

16.2 You are given the following data about a small project. Find the critical path and the completion time of the project:

Activity	:	K	L	M	N	P
Immediate predecessor	:	-	K	K	L, M	N, M
Optimistic time (weeks)	:	8	3	8	2	1
Most likely time (weeks)	:	10	5	8	6	5
Pessimistic time (weeks)	:	12	7	8	16	9

16.3 The earliest-start Gantt chart for the project in example 16.1 is as follows:

Activity \ Time in days	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
S	■	■	■																			
T				■	■	■	■															
W				■	■	■	■	■	■	■	■											
U												■	■	■	■							
V												■	■									
Y																■	■	■	■	■	■	■

a. i. How many activities that must be completed before activity V?
ii. How many activities are parallel to activity W?
iii. How many activities are parallel to activity Y?
iv. How many activities are critical?

b. Identify the critical path.
i. How much is the slack time of activity V?
ii. How much is the slack time of activity W?
iii. How much is ES and EF of activity T?
iv. How much is LS and LF of activity U?
v. How much is the completion time of the project?

Interpretation of the symbols used in the above equations:

AFC : Average fixed cost
ATC : Average total cost
ATI : Average Transportation Inventory
AVC : Average variable cost
BEP : Breakeven point in units of output
CU : The annual costs of goods sold *or* the annual usage of goods sold
D : Annual or yearly demand
d : Demand rate (per day or per week or per month, etc.)
d_{run} : Quantity of material used to meet immediate demand during a production run in the EPQ model
ds : Days of supply
EOQ : Economic order quantity
EPQ : Economic production quantity
H : Annual holding cost per unit of inventory
$I_{average}$: Average inventory
I_{build} : Inventory build- up rate
I_{max} : Maximum inventory
I_{min} : Minimum inventory
I_{turn} : Inventory turnover.
L : Lead time
N : Number of orders per year in the EOQ model, number of production runs per year in the EPQ model
P : Price per unit of output, production rate (per day or per week, or per month, etc.) in the EPQ model
π : Profit (or loss)
Q : Quantity of output in units, optimal quantity in inventory models, the indifference point in in-sourcing-vs. - Outsourcing decisions.
R : Reorder point in inventory models
S : Ordering cost per order in the EOQ model, the setup cost per production run in the EPQ model
TC : Total costs
TFC : Total fixed costs
TR : Total revenues
TVC : Total variable costs
t : Transit time when calculating the ATI , the time or length of the production run in the EPQ model
t_{cycle} : Time or length of the inventory cycle in inventory models
ws : Weeks of supply

INFORMATION ABOUT CHAPTER 16

In the forward pass of the network

1. ES of an activity = EF of the predecessor (previous) activity.

   If there is more than one 'EF' we choose the longest EF.

2. EF of an activity = ES + D

In the backward pass

3. LF of any activity = LS of the following activity
   If there is more than one' LS' we choose the shortest LS

4. LS of any activity = LF - D

In general

5. S = LS – ES OR S = LF – EF

6. for the first activity in the network, always
   ES = LS = 0
   EF = LF
   S = 0

7. for the last activity, always
   ES = LS
   EF = LF
   S = 0

8. $t_e = \frac{(t_o + 4\,t_m + t_p)}{6}$, where $t_e \leq t_m \leq t_p$

9. t_m is the mode of the beta probability distribution and t_e is the mean of this distribution.

10. The horizontal bars in the Gantt chart represent the durations or the times of the activities, where the beginning of the bar is the ES of the activity and the end of the bar is the EF of that activity.

Where

EF: the earliest finish time of an activity.
ES: the earliest start time of an activity.
D: the activity duration or time
LF: the latest finish time of an activity
LS: the latest start time of an activity
S: the slack time of an activity
t_e : the expected or average time of an activity
t_m : the most likely time of an activity
t_o : the optimistic time of an activity
t_p : the pessimistic time of an activity

End of the examples sheet.

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