Mansoura University
Faculty of Engineering
Prod. Eng. Dept.

4th Year Prod. Engineering
Analysis of Prod. Systems
Final Term Exam Jan. 2013

Time 3 Hours
Marks: 70

Answer the following questions, all are equal marks:-

Q1 : Consider the problem of assigning four operators to four machines. The assignment costs in dollars are given below. Operator 1 can't be assigned to machine 3. Also, operator 3 can't be assigned to machine 4.

		Machine			
		1	**2**	**3**	**4**
Operator	**1**	5	5	-	2
	2	4	7	2	3
	3	3	9	5	-
	4	2	7	6	7

(a) Find the optimal assignment.
(b) Formulate the problem as an linear programming one.
(c) Suppose a 5th machine is made available. Its respective assignment costs in dollars to the four operators are 2, 1, 2 and 8. The new machine replaces an existing one if the replacement can be justified economically. Reformulate the problem as an assignment model and find the optimal solution. In particular, is it economical to replace one of the existing machines ? If so, which one ?

Q2 : (a) Why Low Break Even Point is desirable and explain in detail how this can be achieved.

(b) A company needs a machine with the capacity of producing 200,000 units annually of a particular product. Two machine suppliers have submitted bids. The A machine will generate $ 80,000 fixed costs per year; but if the capacity of 200,000 units is reached, profit will be $ 80,000 per year. The B machine will have an annual fixed cost of $ 51,000 and will yield a profit of $ 69,000 at 200,000 units. The product price is $ 2 per unit. Determine :-

i- Break Even Point for each machine in units, dollars, and % capacity.
ii- The sales volume at which the two machines achieve equal profit.
iii- The range in units and dollars at which :
(x) Machine A is more profitable than machine B.
(y) Machine B is more profitable than Machine A.

Note : Show your answers in a scaled chart.

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Q3 : (a) Explain in detail and sketches how the management process of a project using network technique is carried out.

(b) A reactor and storage tank are interconnected by 3" insulted process lines that need periodic replacement. There are valves along the lines and at the terminals, and these need replacing as well. No pipe and valves are in stock. Accurate, as built, drawings exist and are available. The line is overhead and requires scaffolding. Pipe sections can be shop fabricated at the plant. Adequate craft labor is available.
The plant methods and standards section has furnished the following data :

Symbol	Activity Description	Time (hrs)
A	Develop required material list	8
B	Procure pipe	200
C	Erect scaffold	12
D	Remove scaffold	4
E	Deactivate line	8
F	Prefabricate sections	40
G	Place new pipe	32
H	Weld pipe	8
I	Fit up pipe and valves	8
J	Procure valves	225
K	Place valves	8
L	Remove old pipe and valves	35
M	Insulate pipes	24
N	Pressure test	6
O	Clean-up and start-up	4

Careful study and consultation with the people directly involved with the various activities has led to the following conclusion :
Activities **A, C,** and **E** require no predecessors other than the beginning of the project. Activity **A** must be done prior to both **B** and **J**. Activity **D** must follow both **I** and **M,** while **N** depends only on **I**. Activity **F** can begin only after **B** is completed, and **G** must wait on both **F** and L. **H** can start as soon as **G** is finished, but **I** depends on both **H** and **K**. **K** is ready to begin as soon as **J** and **L** are completed, but **L** has to wait completion of both **C** and **E**. **M** is preceded by both **H** and **K**. Activity **O**, the last activity in the project, starts when **D** and **N** are finished. Completion of activity **O** completes the project.

i-Draw a network.
ii- Determine the critical path.
iii- How much time is required ?
iv- Prepare a progress report at ¼ project completion time (higher integer)

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Q4 : (a) Briefly explain the decisions can be investigated by managers of a firm faces demand increase of the product produced by its existed plants.

(b) Ace Beverage Company produces a regionally sold line of soft drinks. They have two plants (**A** and **B**) from which they ship to four market areas. Their sales have been growing dramatically. This year's sales forecast and next year's sales forecast are shown below :

Sales Forecast (Thousands Of Cases)		
Area	**This year**	**Next year**
1	2000	2500
2	2000	3000
3	4000	5000
4	2000	2000

The two existing plants each have an annual capacity of 5,000,000 cases (5000 units). The firm has decided to build a new plant that will also have a 5000-unit capacity. Otherwise, they will have insufficient capacity next year. The new plant will be at location **C** or **D**. The production costs anticipated for next year and transportation costs anticipated for next year are shown below, also in units of thousands of cases.

Production Costs ($ / Unit)	
Site	**Cost**
Plant A	$ 1200
Plant B	$ 1200
Plant C	$ 1400
Plant D	$ 1200

Transportation Costs ($ / Unit)				
To: / From:	**Area 1**	**Area 2**	**Area 3**	**Area 4**
Plant A	300	200	300	400
Plant B	500	400	350	250
Plant C	500	400	250	400
Plant D	200	300	450	500

i- Where the new plant is located, Why ?

ii- What is % operating capacity of each plant ?