IEDA 2010 Introduction of Industrial Engineering and Decision Analytics

Sample Midterm Examination

Time Allowed:2 hours

Name: _____

Student ID: _____

Signature: _____

Part I (20%): MC questions. Choose the most suitable answer and write down your answer in the table provided at the end of this part.

1. In an A-B-C system, the typical percentage of the number of items in inventory for A items is about:
A) 10
B) 30
C) 50
D) 70
E) 90

2. In the basic EOQ model, if annual demand doubles, the effect on the EOQ is:
A) It doubles.
B) It is four times its previous amount.
C) It is half its previous amount.
D) It is about 70 percent of its previous amount.
E) It increases by about 40 percent.

3. Which of the following is not a location option that management can consider in location planning?
A) expand an existing facility
B) add a new location
C) relocate from one location to another
D) do nothing
E) All are possible options.

4. Which of the following is not a characteristic of service operations?
A) intangible output
B) high customer contact
C) high labor content
D) easy measurement of productivity
E) low uniformity of output

5. In a project network the critical path is the sequence of activities which has the:
A) most activities
B) most nodes
C) most events
D) longest time
E) greatest variance

6. There are four activities on the critical path. Coincidentally, their standard deviations are all equal to 4. The standard deviation of the critical path is therefore equal to:
A) 2
B) 4
C) 8
D) 16
E) 64

7. Nearness to raw materials would be most important to a _____
A) grocery store
B) tax preparation service
C) manufacturing company
D) post office
E) hospital

8. A popular tool for planning and scheduling simple projects, and for initial planning on more complex projects, is the:
A) activity-on-arrows network
B) activity-on-nodes network
C) Gantt chart
D) critical path method
E) program evaluation and review technique

9. Which of the following is not true about the use of dummy activities in project networking?
A) They preserve the separate identities of activities.
B) They clarify precedence relationships among activities.
C) They have an activity time equal to zero.
D) They have an activity time variance equal to zero.
E) They are used in activities-on-nodes (AON) network diagrams.

10. In project network analysis, “slack” refers to the difference between:
A) observed and predicted times
B) optimistic and pessimistic times
C) mean and modal times
D) finish and start times
E) latest and earliest times

Answer of Part I

1)		**6)**	
2)		**7)**	
3)		**8)**	
4)		**9)**	
5)		**10)**	

Part II (80%): Please answer all questions and write down your answers in the provided spaces.

1. A company will begin stocking remote control devices. Expected monthly demand is 800 units. The controllers can be purchased from either supplier A or supplier B. (Note that you are only allowed to purchase from one supplier.) Ordering cost is $40 and annual holding cost is 25 percent of unit price per unit. Which supplier should be used and what is the optimal order quantity if the intent is to minimize total annual costs? (*round the optimal order quantity to the nearest integer*)

Their price lists are as follows:

Supplier A		**Supplier B**	
Quantity	Unit Price	Quantity	Unit Price
1-199	$14.00	1-149	$14.10
200-499	$13.80	150-349	$13.90
500+	$13.60	350+	$13.70

2. A company produces two products: (1) tablet computers, and (2) keyboard folios. Each tablet sold yields a net profit of $60; each keyboard folio sold yields a net profit of $40. The production process for each product requires a certain number of machine-hours for manufacturing and a certain number of labor-hours for assembling, as shown in the table below:

	Machine-hour Required (hours/unit)	Labor-hour Required (hours/unit)
Tablet	2	4
Keyboard folio	3	2

During the current production period, 120 hours of machine time are available, and 160 hours of labor time are available. Since the tablet can work alone, and the keyboard folio must work with the tablet, the company decides that the production of keyboard folio cannot be larger than the production of tablet. The company's goal is to decide the quantity of each product to be produced to maximize the total net profits.

a) Formulate a Linear Programming model for this problem.

b) Use the graphic method to solve this problem. Clearly mark the feasible region and the process used to find the optimal solution and the maximum profit.

c) Suppose now the company's machine time available does not change, while the labor time available reduces to 120 hours. What is the optimal production plan? What is the maximum profit? Use the graphic method to find it.

3. Assume the network and data given in the following table (the time is in weeks).

Activity	Preceding Activity	Normal Time	Crash Time	Normal Cost	Crash Cost
A	-	7	6	$7,000	$8,000
B	A	3	2	5,000	6,600
C	A	7	6	9,000	10,200
D	B	5	4	3,000	4,500
E	D	3	2	2,000	3,000
F	C, D	4	2	4,000	6,800
G	E, F	5	4	5,000	8,000

a) Draw the project network diagram.

b) If you need to shorten the project duration by 5 weeks, what is the cheapest way to shorten the project? Please provide the final cost for the shortened project.

4. The distribution centers can be located in the center of population zones 1 through 6 at a cost (in hundreds of thousands of dollars) of 150, 110, 170, 140, 120, and 130 respectively. The delivery time must be within 48 hours. The transportation time between each pair of zones is given below.

	2	3	4	5	6
1	60	36	40	72	52
2		48	48	36	60
3			24	60	36
4				72	48
5					36

a) Formulate an appropriate set covering model to determine where the distribution centers are to be located in order to minimize the total cost, and solve the model using the greedy heuristic.
b) What is the cost of locating distribution centers to meet the 48 hours delivery time service level?