AMERICAN UNIVERSITY OF BEIRUT

SULIMAN OLAYAN SCHOOL OF BUSINESS

DCSN 200: OPERATIONS MANAGEMENT

MIDTERM EXAM

November 27, 2010

7:00 PM – 9:00 PM

NAME _____

STUDENT ID _____

SECTION _____

INSTRUCTOR _____

This exam is administered in full observance of the Olayan School of Business Honor Code and the penalties it sets for violations of the standard of academic conduct. You are required to fully understand the code and to strongly adhere to it. In particular, cellular telephones, and computers of any shape or size are not allowed. No questions, no comments, no borrowing and no disturbance of the peace of any kind will be permitted or tolerated. You are required to stop working on the exam and hand it immediately when a proctor instructs you to do so. Any cheating or attempted cheating will subject the offender to a zero on the exam and a referral to the Student Affairs Committee for further penalties.

- Do not start the exam (do not turn to the next page) until instructed to do so
- You have 2 hours to complete the exam. You can answer questions in any order
- Your understanding of the questions is part of the exam. No questions will be answered by instructors. If in doubt, write your assumptions and continue solving
- When you start the exam, make sure that your exam paper has 12 pages
- You must hand in every page of the exam when you finish, including the formula sheet. If any page has become detached, your name must be written on it

- "I vow to complete the exam on my own without giving or receiving help from anyone and to adhere to the academic integrity standards reflected in the AUB student code of conduct"

SIGNATURE _____

PART I.
MULTIPLE CHOICE QUESTIONS (9 points)
CIRCLE THE MOST APPROPRIATE ANSWER

1. The center-of-gravity method does not take into consideration the
   a. location of markets
   b. volume of goods shipped to the markets
   c. value of the goods shipped
   d. combination of volume and distance
   e. the center-of-gravity method considers none of the above

2. East Texas Seasonings is preparing to build one processing center to serve its four sources of seasonings. The four source locations are at coordinates shown below. Also, the volume from each source is provided. What is the center of gravity?

	X-coordinate	Y-coordinate	Volume
Athens, Texas	30	30	150
Beaumont, Texas	20	10	350
Carthage, Texas	10	70	100
Denton, Texas	50	50	200

   a. X = 28.125; Y = 31.25
   b. X = 22000; Y = 24000
   c. X = 27.5; Y = 40
   d. center of gravity = 28
   e. none of the above

3. Time-series data may exhibit which of the following behaviors?
   a. Trend
   b. random variations
   c. seasonality
   d. cycles
   e. They may exhibit all of the above

4. In exponentially smoothed time series, the smoothing constant α is chosen on the basis of how much smoothing is required. In general, which of the following statements is true?
   a. A small value of α such as α = 0.1 results in very little smoothing, while a large value such as α = 0.8 results in too much smoothing
   b. A small value of α such as α = 0.1 results in too much smoothing, while a large value such as α = 0.8 results in very little smoothing
   c. A small value of α such as α = 0.1 and a large value such as α = 0.8 may both result in very little smoothing
   d. A small value of α such as α = 0.1 and a large value such as α = 0.8 may both result in too much smoothing

5. Which of the following workers is the most productive?
   a. $50 wages, 10 parts produced
   b. $10 wages, 1 part produced
   c. $30 wages, 5 parts produced
   d. $100 wages, 21 parts produced
   e. $500 wages, 100 parts produced A steel production facility is an example of a repetitive process

6. One of the similarities between process focus and mass-customization is
   a. The volume of outputs
   b. The process layout
   c. The standard cost
   d. The variety of inputs
   e. All of the above are similarities

7. Which of the following is **false** regarding repetitive processes?
   a. They use modules.
   b. They allow easy switching from one product to the other.
   c. They are the classic assembly lines
   d. They have more structure and less flexibility than a job shop process
   e. They are commonly used in the assembly of automobiles

8. Which of the following is **false** regarding RFID technology?
   a. It means Radio Frequency Identification
   b. It is used in CAD systems
   c. It helps a better management of the logistics
   d. It is similar to bar codes but is much more expensive
   e. It allows customers to track the origin of the products components

9. A full-service restaurant is considering opening a new facility in a specific city. The table below shows its ratings of four factors at each of two potential sites

Factor	*Weight*	Gary Mall	Belt Line
Affluence of local population	0.20	30	30
Traffic flow	0.40	50	20
Parking availability	0.20	30	40
Growth potential	0.20	10	30

The score for Gary Mall is _____ and the score for Belt Line is _____.

   a. 120; 120
   b. 22 ; 24
   c. 18 ; 120
   d. 34 ; 28
   e. None of the above

SHORT ANSWERS (10 points)

Write your answers in the space provided. Be concise and follow the instructions closely. If you run out of space, continue on the back of the previous page, but indicate this fact clearly.

1. (4 points)

a. State the typical phases of a product life cycle

b. Give an example for each phase (one product per phase)

2. (4 points)

For the last six months, a retail store has hired two forecasting analysts. At the beginning of each month each analyst predicts independently a sales number. At the end of the month, the manager compares the forecasted numbers with the actual sales. The manager has just compiled the results.

Analyst 1 was off by exactly 50units/month for the last six months.

Analyst 2 was off by exactly 250units in the first month and off by 10units/month for the remaining five months.

Which analyst has performed better in the last months?

a. if the operations manager uses sum of squares of forecast error (MSE)

b. if the manger is using a mean absolute deviation measure (MAD)

Explain your answer. No need for heavy calculations.

3. (2 points)

What is the forecast for May using a four-month moving average?

Compare it to a naïve approach.

Nov.	Dec.	Jan.	Feb.	Mar.	April
39	36	40	42	48	46

PART II.

Question 1 (24points)

American University of Beirut, has witnessed tremendous growth in its football program. With that growth has come more fame, the need for a bigger stadium, and more complaints about seating, parking, long lines, and concession stand prices. AUB's president, Dr. Peter F. Dorman, was not only concerned about the cost of expanding the existing stadium versus building a new stadium, but also about the ancillary activities. He wants to be sure that these various support activities generate revenue adequate to pay for themselves. At a recent meeting discussing the new stadium, Dorman told you as stadium manager, to develop a break-even analysis specifically for the food and beverages services. You developed the table below. This table shows the expected percent of revenue by item, the suggested selling prices, and the estimate of variable costs.

Item	Selling Price/Unit	Variable Cost/Unit	Percent Revenue
Soft drink	$1.00	$0.50	25%
Coffee	$2.00	$0.75	15%
Hot dogs	$4.00	$2.50	20%
Hamburgers	$5.00	$3.00	25%
Misc. snacks	$2.00	$0.75	15%

In terms of fixed costs, you estimated that the prorated portion of the stadium cost would be: salaries for food services at $100,000 ($20,000 for each of the five home games); 2,400 square meters of stadium space at $2 per square meter per game; and for each game, six staff in each of the six booths for 5 hours at $7 an hour per staff.

Your report for the president should include the answers for the following questions:

a. (6 points). What is your break-even point in dollars for all food and beverages sales per game?

b. (5 points). At breakeven what are your sales of i.) drinks (Soft drink and Coffee) ii.) Food (Hot Dogs and Hamburgers) and iii.) Misc. snacks? How many units of Misc. snacks should you sell at breakeven.

c. (2 points). Assume that you expect 27,000 attendees. How much should every attendee spend (on average) on each of the five items to reach breakeven?

d. (5 points). Using the results of part (c.) in terms of how much each attendee should spend on each item, what is your profit if 70,000 people show up at a game? *(If you did not do part (c.), you could assume any values for (c.) and continue.)*

e. (6 points) Based on your experience, you think there is 30% chance of having 70,000 attendees and 70% chance of having 27,000 attendees. Akra Catering approaches you and suggests the following: You pay the fixed costs and in return you get a fixed $0.90 per attendee (independently of what was consumed). Should you accept this offer? For that draw a simple decision tree. What is the best expected profit? (*You may draw the decision tree in pencil.)*

Question 2 (22points)

Consider the orders currently held by a wedding dressmaker:

Job	Date received	Due Date	Work Remaining (days)
Amiele	2nd	13th	6
Birna	3rd	10th	3
Crystl	4th	9th	3
Dima	5th	11th	8

a. (14points). Today is the 6th of the month. The dressmaker is aware that its reputation depends on making the wedding dresses on time. At present it uses a FCFS sequence. What order of jobs would you suggest for the dressmaker? Justify your answer.
[Hint: You may wish to consider critical ratio (CR, shortest processing time (SPT), and earliest due dates (EDD) scheduling policies.]

b. (8 points). Based on the sample above, compute how long on average a dress spends at the dressmaker? [*Compare again the three scheduling policies CR, SPT and EDD].* Conclude*. You may use previous calculations.*

Question 3 (15points)

The quarterly earnings (in USD millions) of a large soft-drink manufacturer have been recorded for the years 2006 to 2009.

	Year			
Quarter	**2006**	**2007**	**2008**	**2009**
1	**52**	**57**	**60**	**66**
2	**67**	**75**	**77**	**82**
3	**85**	**90**	**94**	**98**
4	**54**	**61**	**63**	**67**
Yearly	**258**	**283**	**294**	**313**

a. (6points). Compute the quarterly indexes

b. (6points). Based on the yearly data above, the manufacturer has built a trend line to forecast yearly earnings. The equation of this (yearly) line is: $\hat{y} = 243 + 17.6\,t$.

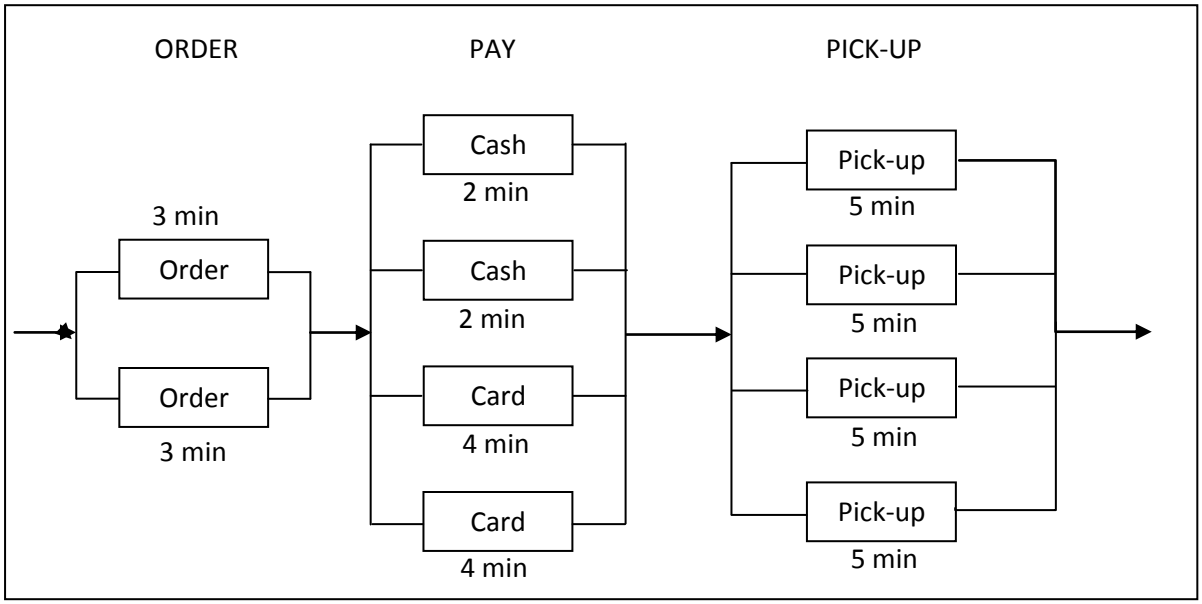
   i.) What are the forecasted yearly earnings for 2015? Calculate the average forecast of a quarter in 2015

   ii.) Forecast the quarterly earnings for the year 2015.

c. (3points). Discuss briefly why, in this problem, a four-period moving average is not recommended to forecast quarterly earnings.

Question 4 (20points)

A drive-through process at a fast food restaurant is shown below. Customers drive-in, place an order, pay (either by cash OR by credit card), pick-up their order and leave. Each box is a station and its processing time is given in minutes.



a. (4 points). What is the process cycle time for the overall system? Explain

b. (5 points). Which operation is the bottleneck? Explain carefully your answer.

c. (3 points). What is the system's process time?

d. (3 points). If the firm operates 10 hours per day, 22 days per month, what is the monthly capacity of the drive-through process?

e. (5 points). Each box in your network is managed by one employee. The firm encountered some financial difficulties. It needs to cut on cost. It decided to retain only 6 employees for the entire drive-through operation. How would you place your employees to maximize capacity? What is the system's capacity in this case?

Formula Sheet:

$$\text{Moving average} = \frac{\sum \text{demand in previous } n \text{ periods}}{n}$$

$$\text{Weighted moving average} = \frac{\sum (\text{weight for period } n) \times (\text{demand in period } n)}{\sum \text{weights}}$$

$$F_t = F_{t-1} + \alpha(A_{t-1} - F_{t-1})$$

$$F_t = \alpha(A_{t-1}) + (1 - \alpha)(F_{t-1} + T_{t-1}) \qquad T_t = \beta(F_t - F_{t-1}) + (1 - \beta)T_{t-1}$$

$$FIT_t = F_t + T_t$$

$$MAD = \frac{\sum |\text{Actual} - \text{Forecast}|}{n} \qquad MSE = \frac{\sum (\text{Forecast Errors})^2}{n}$$

$$MAPE = \frac{\sum_{i=1}^{n} 100|\text{Actual}_i - \text{Forecast}_i|/\text{Actual}_i}{n}$$

$$\hat{y} = a + bx \qquad b = \frac{\Sigma xy - n\bar{x}\bar{y}}{\Sigma x^2 - n\bar{x}^2} \qquad a = \bar{y} - b\bar{x}$$

$$S_{y,x} = \sqrt{\frac{\sum y^2 - a\sum y - b\sum xy}{n - 2}} \qquad r = \frac{n\Sigma xy - \Sigma x \Sigma y}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]}}$$

$$\text{Tracking signal} = \frac{\sum(\text{Actual demand in period } i - \text{Forecast demand in period } i)}{(\sum|\text{Actual} - \text{Forecast}|/n)}$$

$$BEP_{\$} = \frac{F}{\sum\left[\left(1 - \frac{V_i}{P_i}\right) \times (W_i)\right]}$$