THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

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MAIN EXAMINATION

MAY – JULY 2016 TRIMESTER

FACULTY OF COMMERCE

DEPARTMENT OF ACCOUNTING AND FINANCE

REGULAR PROGRAMME

CMS 321: ANALYTICAL DECISION MAKING

Date: JULY 2016	**Duration: 2 Hours**
INSTRUCTIONS: Answer Question ONE and ANY OTHER TWO Questions	

Q1. a) Industrial designs has been awarded a contract to design a label for a new wine product by Kenya Wine Agencies Limited (KWAL). The company estimates that 100 hours will be required to complete the project. Three of the firm's graphic designers are available for assignment to this project: Lisa, a senior designer and team leader, David, a senior designer, and Sarah, a Junior designer. Because Lisa has worked on several projects for KWAL, management has specified that Lisa must be assigned at least 50% of the total number of hours that are assigned to the two senior designers. To provide label-designing experience for Sarah, Sarah must be assigned at least 15% of the total project time. However, the number of hours assigned to Sarah must not exceed 25% of the total number of hours that are assigned to the two senior designers. Due to other project commitments, Lisa has a maximum of 50 hours available to work on this project. Hourly wage rates are $30 for Lisa, $25 for David, and $18 for Sarah.

Required:
You are a consultant to KWAL, providing guidance in decision making using analytical decision making models. Formulate a linear programming model that can be used to determine the number of hours each graphic designer should be assigned to the project in order to minimize total cost.

(NB: Do not solve the LP model since a computer program that solves this kind of management science problems is available). **(13 marks)**

b) IBM has set up three plants in Africa that will manufacture the central processing unit (CPU) for its line of personal computers. The plants are located in Nairobi (Kenya), Johannesburg (South Africa), and Cairo (Egypt). The CPUs will be shipped to warehouses in various regions of the African continent designated as W_1, W_2, W_3, W_4 and W_5 respectively for further distribution to markets on the continent. The following table shows the number of CPUs required by each warehouse and the shipping costs (dollars per unit).

Plant	W_1	W_2	W_3	W_4	W_5	CPUs Available
Nairobi	10	20	5	9	10	9000
Johannesburg	2	10	8	30	6	4000
Cairo	1	20	7	10	4	8000
CPUs required	3000	5000	4000	6000	3000	

Required:

i) Develop a linear programming model that can be used to determine the amount that should be shipped from each plant to each warehouse in order to minimize total shipping cost for the transportation problem. **(5 marks)**

ii) Explain how your linear programming model would accommodate the following variations in the transportation problem. (NB: where necessary provide the required constraint)

I) Demand exceeds supply. **(2 marks)**
II) Cairo – W_2 route is unusable. **(2 marks)**
III) Nairobi – W_3 route must carry at least 2000 units. **(2 marks)**

c) Mrs. Dida wants to open a cafeteria in Kisumu. A small business enterprise adviser, whom she approached, listed for her six major activities to carry out. The table below gives a summary of the normal time estimates of each activity, crash time and cash cost per day:

Activity	Predecessor	Normal time (Weeks)	Crash time (Weeks)	Cost slope (Shs.)
A. Procurement of materials	-	3	3	-
B. Plumbing	A	6	4	45,000
C. Masonry	-	5	3	30,000
D. Electrical works	C	8	7	60,000
E. Carpentry	C	6	4	22,500
F. Finishing	B, D, E	4	2	75,000

Required:

i) What is the shortest time in which this project can be completed if the required financial resources are available? **(5 marks)**

ii) What is the additional cost to be incurred if all activities are maximumly crashed as recommended in the schedule above? **(3 marks)**

Q2. Consider the following minimum cost transport problem:

	DESTINATION			
ORIGIN	D_1	D_2	D_3	Supply
O_1	4	10	6	100
Q_2	8	16	6	300
Q_3	14	18	10	300
Demand	200	300	200	700

a) Use the transportation simplex method to find an optimal solution. What is the total transportation cost for the optimal solution? **(10 marks)**

b) Because of read construction, the O_2 – D_3 route is now unacceptable. Determine the optimal transportation plan and the total transportation cost. **(10 marks)**

Q3. Dale Jensen , specializes in the restoration of vintage Porsche automobiles. One of Jensen's regular customers asked him to prepare an estimate for the restoration of a 1964 model 356SC Porsche. To estimate the time and cost to perform such a restoration, Jensen broke the transportation process into four

separate activities: disassembly and initial preparation work (A), body restoration (B), engine restoration (C), and final assembly (D). Once activity A has been completed, activities B and C can be performed independently of each other, however, activity D can be started only if both activities B and C have been completed. Based on his inspection of the car, Jensen believes that the following time estimates (in days) are applicable.

Activity	Optimistic	Most probable	Pessimistic
A	3	4	8
B	5	8	11
C	2	4	6
D	4	5	12

Jensen estimates that the parts needed to restore the body will cost $3000 and that the parts needed to restore the engine will cost £5000. His current labour costs are £400 a day.

Required

a) Work out the expected project completion time. **(4 marks)**

b) Jensen's business philosophy is based on making decisions using a best and worst case scenario. A best case scenario is where the project takes the shortest or least time to complete ie optimistic time and the worst case scenario is where the project takes the longest or most time to complete ie pessimistic time. Develop cost estimates for completing the restoration based on

   i A best case analysis and
   ii A worst case analysis. {Assume that the total restoration cost is the sum of the labour costs and material (parts plus engine) costs} **(8 marks)**

c) If Jensen obtains the job on a bid of K£ 16,800 what is the probability he will lose money on the job? Assume the project completion time is normally distributed (Hint: on a bid of $ 16,800 Jensen needs to complete the job in 22 days in order to break even. **(8 marks)**

Q4. Agan interior design provides home and office decorating assistance to its customers. In normal operation, an average of 2.5 customer arrive each hour. One design consultant is available to answer customer questions and make product recommendations. The consultant averages 10 minutes with each customer.

Required

a) Determine the following characteristics of the customer wanting line, assuming poisson arrivals and exponential service times.
   i The mean arrival rate λ_1 and mean service rate μ **(2 marks)**

ii The average number of customers in the waiting line, Lq **(4 marks)**
iii The average time a customer spends in the waiting line Wq **(4 marks)**
iv The average time a customer spends in the system, W. **(4 marks)**
v The probability that a arriving customer has to wait for service Pw **(4 marks)**

b) Service goals dictate that an arriving customer should not wait for service income than an average of 5 minutes. Is this goal being met? If not, what do you recommend? **(2 marks)**

END