UNIVERSITY OF COLOMBO, SRI LANKA
FACULTY OF MANAGEMENT AND FINANCE

Bachelor of Business Administration (Semester-V) Examination, July 2018

FIN-2300/ACT/HRM/MOS-2307 Management Science Applications

Three (03) Hours

Answer All Questions
Formula Sheet is provided
Use of non-programmable calculators is permitted.

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01. Consider the following final Simplex table for a Linear Programming problem:

Cj Cb	Basis	Solution	40 X1	24 X2	52 X3	23 x4	0 s1	0 s2	0 s3	0 s4	0 s5	0 s6
24	X2	50	0	1	1/2	0	-1/5	2/5	0	0	0	-1
0	S4	10	0	0	-1	0	-3/5	1/5	0	1	0	-3
0	S3	530	0	0	2 1/2	0	-5	0	1	0	0	-13
40	X1	10	1	0	1	0	3/5	-1/5	0	0	0	3
0	S5	16	0	0	1	0	0	0	0	0	1	0
23	X4	10	0	0	0	1	0	0	0	0	0	-1
	ZJ	**1830**	40	24	52	23	19.20	1.60	0	0	0	73
	CJ-ZJ		0	0	0	0	-19.20	-1.60	0	0	0	-73

i.   Identify the optimum solution.
ii. What is the marginal value of an additional unit of resource in the first constraint? What is the range of b_1 within which the marginal value is valid ($b_1 = 120$)?
iii. Is there an alternative solution? If so, identify the new solution. (provide only the first three column of the table)
iv. Suppose that the firm can obtain 10 additional units of the resource for the fourth constraint at $ 10 each ($b_4 = 20$). Should it obtain these additional units? Why or why not?
v.   Suppose that the firm can obtain additional resources for the second constraint at $ 1 per unit ($b_2 = 160$). Should it purchase the additional resources? If so how many units?
vi. Suppose the firm signed a trade agreement with it's competitor, and the agreement resulted the selling price (Cj) of X1 changed to $ 35. Would it affect the present optimum solution? Explain your reasons.

(Total 23 Marks)

02. Bayville in U.S. has built a new elementary school, increasing the town's total to four schools -Addison, Beeks, Canfield, and Daley. Each has a capacity of 400 students. The school board wants to assign children to schools so that their travel time by bus is as short as possible. The school board has partitioned the town into five parts conforming to population density-north, south, east, west, and central. The average bus travel time from each part to each school is shown as follows:

Districts	Travel Time (Minutes)				
	Addision	Beeks	Canfield	Daley	Student Population
North	12	23	35	17	250
South	26	15	21	27	340
East	18	20	22	31	310
West	29	24	35	10	210
Central	15	10	23	16	290

Determine the number of children that should be assigned from each district to each school to minimize total student travel time.

(18 Marks)

3. i. The National Express Parcel Service has established various truck and air routes around the country over which it ships parcels. The holiday season is approaching, which means a dramatic increase in the number of packages that will be sent. The service wants to know the maximum flow of packages it can accommodate (in tons) from station 1 to station 7. The network of routes and the flow capacities (in tons of packages per day) along each route are shown in the following network:
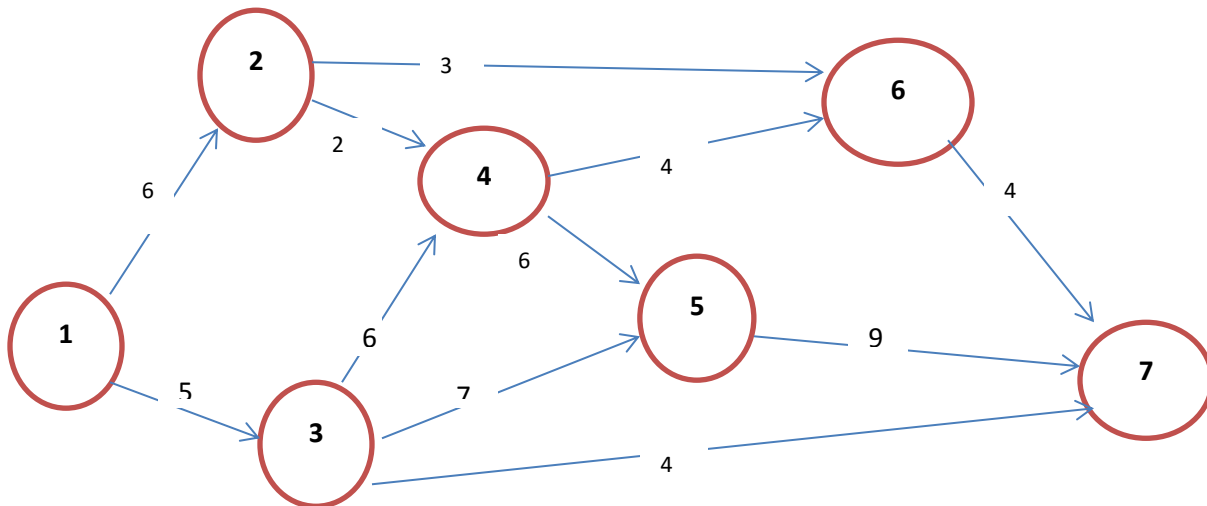
Determine the maximum tonnage of packages that can be transported per day from station 1 to station 7.

(06 Marks)

3. ii. The following table provides the information necessary to construct a project network and project crash   data:

Activity	(i, j)	Activity Predecessor	Activity Time		Activity Cost	
			Normal	Crash	Normal	Crash
A	(1,2)	-	16	8	$ 2,000	$ 4,400
B	(1,3)	-	14	9	1,000	1,800
C	(2,4)	A	8	6	500	700
D	(2,5)	A	5	4	600	1,300
E	(3,5)	B	4	2	1,500	3,000
F	(3,6)	B	6	4	800	1,600
G	(4,6)	C	10	7	3,000	4,500
H	(5,6)	D,E	15	10	5,000	8,000

a. Construct the project network.

b. Manually crash the network to 28 weeks and calculate the total cost.

c. What is the maximum number of weeks the project can be crashed up to the optimum point? Calculate the total cost.

(18 Marks)

(Total 24 Marks)

04.

i.   What are the FOUR status of decision environment?   Discuss which Management Science Techniques could be useful for decision problems under each of these states.

(05 Marks)

ii.   Greenwood Lumber Mill. Inc. (GLM) in process 20,000 logs during its 250 operations days per year. GLM has a contract with a logging company that delivers logs immediately upon order at the rate of 120 logs per day. GLM has estimated that the ordering cost per order is $ 125 and the holding cost (while logs are held for processing) is $ 30 per log annually.

a. Determine the optimum log order.
b. Determine the total inventory cost associate with the optimum order quantity.
c. Illustrate the inventory level model graphically and indicate the number of lumber mill operating days between orders.
d. Determine the number of lumber mill operating days before receiving an order.

(10 Marks)
(Total 15 Marks)

05. William Joseph operates the family-owned peanut farm and the nut factory "William Nuts" of Georgia, Inc. in U.S.A. William Nuts, as the company is known nationwide, is a major producer of cocktail nuts, beer nuts for airlines, and peanut butter. The company is seriously considering a new product, a chocolate-covered candy bar with the label of William chocolate Nuts.

The development cost involved in introducing this new product is estimated to be $ 1 million. The cost includes marketing research, new equipment, new personnel, and training programs for the employees. The profit from William Chocolate Nuts depends on three things:

1. whether Galaxie Candy Company , the chief competitor of William Nuts, would introduce a similar product,
2. the type of advertising campaigns that William Nuts launches and
3. the type of advertising campaign that Galaxie uses to counter the promotional effort of William Nuts.

If the company introduces William Chocolate Nuts and Galaxie does not introduce a similar product, William Nuts can launch a major advertising campaign and maximize profit. If Galaxies introduces a similar candy bar, the profit will depend on the advertising efforts of the firm and that of Galaxies. William Nuts is considering three types of advertising campaign based on the costs involved: a major campaign (with a cost of $ 0.5 million), a regular campaign (with the cost of $ 0.2 million), or a minor campaign (with the cost of $ 0.1 million).

William Joseph has asked the vice-president of marketing, to determine whether the new product should be introduced and if so which advertising campaign the company should adopt.   The vice-president after spending a considerable   amount of time reviewing his old Management Science tests, constructed the following table :

William Nuts introduction decision	Galaxie reaction to introduction & their probability		William Nuts advertisement decisions	Galaxie advertisement reaction & their probability		Conditional pay-off $ Mn.
Introduce	Introduce	P= 0.6	Major Ads	Major	P= 0.5	1.0
				Regular	P= 0.3	1.4
				Minor	P= 0.2	2.5
			Regular Ads	Major	P= 0.5	0.8
				Regular	P=0.3	1.2
				Minor	P=0.2	2.3
			Minor Ads	Major	P=0.5	0.5
				Regular	P=0.3	1.0
				Minor	P=0.2	2.1
	Do not introduce	P= 0.4	Major Ads			4.2
			Regular Ads			3.0
			Minor Ads			2.5
Do not introduce						0

As indicated in the above table, at the first decision point William Nuts has two alternatives: the firm may introduce the product or it may not introduce the product. If, William Chocolate Nuts is not introduced, the conditional profit will of course be 0. If the company introduces William Chocolate Nuts, Galaxie Candy Company has two alternatives as its reactions:

(i)   It may introduce similar candy bar, or
(ii)   It may not introduce similar product.

The probabilities of these events are given in the above table.

At the second decision point, William Nut has three adverting strategies. However, if Galaxie introduces a similar candy bar, the advertising campaign selected by William Nuts is expected to be challenged by one of the identical three types of advertising campaign of Galaxies own and shown them in the table with their probabilities. If Galaxie does not introduce a similar candy bar, the advertising efforts of William Nuts will not bring any reaction from Galaxies. If, William Nuts major campaign is answered by a major campaign from Galaxie, the conditional profit is estimated to be & 1 million. Likewise, other combinations of advertise campaigns, probabilities, and conditional profits are calculated in the last column.

These profit figures do not include the total development cost of $ 1 million and the advertising cost. When William Nuts initiates an advertising campaign, in incurs cost for preparing the ad and running the ad in the various media selected. Launching a Major ad is estimated to cost $ 0.5 million, a Regular ad $ 0.2 million, and a Minor ad $ 0.1 million.

How the vice-president of marketing advise to William Joseph to determine whether the new product should be introduced and if so which advertising campaign the company should adopt?

(20 Marks)