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RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. General Degree in Applied Sciences
Fourth Year – Semester II Examination – April/ May 2016

MAT 4304 – OPERATIONAL RESEARCH II

Answer **All** Questions. Time allowed: **Three** Hours

01 Consider a project having the following activities and their time estimates in days:

Activity	*Predecessor*	t_o	t_m	t_p
A	-	2	4	6
B	A	8	12	16
C	A	14	16	30
D	B	4	10	16
E	C, B	6	12	18
F	E	6	8	22
G	D	18	18	30
H	F, G	8	14	32

t_o: Optimistic time t_m : Most likely time t_p : Pessimistic time

Draw a network for the above project.

Using the above data, construct an Excel spreadsheet model and simulate it with 25 runs, and hence determine

(i) the average project completion time and

(ii) percentage of each activity being critical.

Assume that the duration time of each activity follows a Triangular distribution.

[P.T.O.]

02 At a toll office a sample of 100 arrivals of vehicles gives the following frequency distribution of the inter arrival and service time:

Inter arrival time (minutes)	*Frequency*	*Service time*	*Frequency*
1.0	2	1.5	10
1.5	5	-	-
2.0	9	2	22
2.5	25	-	-
3.0	22	2.5	40
3.5	11	-	-
4.0	10	3.0	20
4.5	6	-	-
5.0	3	3.5	8
5.5	2	-	-

There is a clerk in the office. Using Excel Microsoft Applications simulate the process for 20 arrivals and estimate the percentage vehicle waiting time and average percent idle time of the clerk.

03 Consider the following set of activities:

Activity	Days Required	Predecessor
A	3	-
B	4	A
C	4	A
D	3	A
E	3	D
F	4	B
G	6	B
H	5	F, C, E
I	6	G, H
J	4	F, C, E
K	2	D
L	6	L, J, K

(i) Draw the CPM network for this problem.

(ii) Manually determine the earliest and latest start and finish times for each activity and the amount of slack for each activity. What is the critical path and earliest time the project can be completed?

(iii) Formulate linear programming models to determine the earliest and latest start and finish times for each activity and the amount of slack for each activity. Implement the models in MS Excel and hence solve.

04 A manufacturer has order to supply goods at a uniform rate of R per unit time. No shortages are allowed. He starts a production run every t time units, where t is fixed and the set up cost per production run is C_3. Replacement is instantaneous. C_1 is the cost of holding one unit in inventory for a unit time.

Determine the optimum

(i) production run

(ii) scheduling period.

A manufacturer has to supply 12,000 units of a product per year to his customer. The demand is fixed and known and the shortage cost is assumed to be negligible. The inventory holding cost is Rs. 0.20 per unit per month and the setup cost per run is Rs. 350. Determine

(a) the optimum run size

(b) optimum scheduling period.

05 Consider the manufacturing model with no shortages. It is assumed that the run sizes are constant and that a new run will be started whenever inventory is zero. Let

R = number of items required per unit time
K = number of items produced per unit time
C_1 = cost of holding per item per unit time
C_3 = cost of setting up a production run
q = number of items produced per run
t = time interval between runs

Determine the optimum

(i) lot size

(ii) time interval

A company has a demand of 12,000 units per year for an item and it can produce 2,000 items per month. The cost of one setup is Rs. 400 and the holding cost per unit per month is Rs. 0.15.

(i) Find the optimum lot size and the total cost per year, assuming the cost of one unit as Rs. 4.

(ii) Find the maximum inventory, manufacturing time and total time.