ÙeeleeÙeele mecemÙee keÙee n? Skeâ keâchevee keâ heeme leeve JeÙejneTme W_1, W_2, W_3 leLee heeÛe YeC[ej S_1, S_2, S_3, S_4, S_5 n~ Jemle keâe JeÙejneTme hej GheueyOelee W_1 : 4; W_2 : 8; W_3 : 9 SJe eJeeYeVe YeC[eje hej ceeie S_1 : 3, S_2 : 3; S_3 : 4; S_4 : 5 and S_5 : 6 n~ Skeâ Jemle keâe JeÙejneTme me YeC[ej lekeâ ue peeve keâe oj evecve n~ meeceeve keâe Yepeve keâ F°lece lejekeâ keâe evekeâeeueÙe epememe meeceeve keâe eJeeYeVe YeC[eje lekeâ Yepeve keâe KeÛe vÙevelece ne mekeâ~

Store (YeC[ej)

		S_1	S_2	S_3	S_4	S_5
	W_1	2	11	10	3	7
Warehouse	W_2	1	4	7	2	1
(JeÙejneTme)	W_3	3	9	4	8	12

Unit-II / FkeâeF-II

4. What is the problem of queuing theory? Describe characteristics of M/M/1 model. Obtain the expression for waiting time distribution.
keâleej mecemÙee keÙee n? M/M/1 cee[ue keâe ceKÙe eJeMe<elee S JeeCele keâeepeÙe~ Øelee#ee meceÙe yeŠve keâe JÙepekeâ evekeâeeueÙe~

5. An airline organization has one reservation clerk on duty in its local branch at any given time. The clerk handles information regarding passenger reservation and flight timings. Assume that the number of customers arriving during any given period is Poisson distribution with an arrival rate eight per hour and that the

A (Printed Pages 8)

Roll No. _____

S-708

B.Sc. (Part-III) Examination, 2015

(Regular & Exempted)

STATISTICS

Third Paper

(Operation Research)

Time Allowed : Three Hours] ***[Maximum Marks : 75***

Note : Answer five questions in all, taking one question from each Unit. Question No. 1 is compulsory.
ØelÙekeâ FkeâeF me Skeâ ØeMve uele nS, keâue heeÛe ØeMvee keâ Gòej oeepeS~ ØeMve me. 1 DeeveJeeÙe n~

1. (a) What do you mean by linear programming problem? Give an example.
jeKekeâ Øe›eâceve mecemÙee me Deehe keÙee mecePele n? Skeâ GoenjCe oeepeÙe~

(b) Define basic solution. When does it become degenerate?
DeeOeejYele nue keÙee n? Ùen [epevejš keâye nelee n?

(c) State the fundamental theorem of duality.
ÉleJeeo keâe ceeeuekeâ emeæevle yeleeFS~

(d) What do you mean by slack and surplus variables?
eMeeLeue SJe Deeleejòeâ Ûejeme Deehe keÙee meceÞeÙe n?

(e) Explain queue length, waiting time in a queue and waiting time in system of queueing system.
keâleej ØeCeeuee keâ keâleej keâe uecyeeF, keâleej ce Øelee#ee meceÙe leLee keâleej ØeCeeuee ce Øelee#ee meceÙe keâe meceÞeeFS~

(f) What is a assignment problem? Give its mathematical formulation.
eveÙeleve mecemÙee keÙee n? Fmekeâe ieeCeleeÙe me$eekeâjCe oeepeÙe~

(g) Define critical activity and critical path.
›eâeevlekeâ keâeÙe leLee ›eâeevlekeâ heLe keâe heejYeee<ele keâeepeÙe~

(h) Explain pessimistic time, optimistic time and most likely time used in PERT.
heš ce ØeÙeòeâ neve Jeeue evejeMeepevekeâ meceÙe, DeeMeeJeeoe meceÙe leLee Deele mecYeeeJele meceÙe keâe meceÞeeFS~

(i) What is the problem of job sequencing?
keâeÙee keâ ›eâceekeâjCe keâe mecemÙee keÙee n?

(j) What do you mean by economic order quantity (EOQ)?
DeLe ›eâce heejceeCe me Deehe keÙee meceÞele n?

Unit - I / FkeâeF - I

2. Solve the following linear programming problem by Simplex Method :
Maximize : $Z = 3x_1 + 5x_2 + 4x_3$
Subject to the constraints

$$2x_1 + 3x_2 \le 18$$
$$2x_2 + 5x_3 \le 10$$
$$3x_1 + 2x_2 + 4x_3 \le 15$$
$$x_1, x_2, x_3 \ge 0$$

evecveeueeKele jeKekeâ Øe›eâceve mecemÙee keâe emecheuekeme eJeeOe Éejeneue keâeepeÙe :
cenòece keâeepeÙe : $Z = 3x_1 + 5x_2 + 4x_3$
peyeekeâ

$$2x_1 + 3x_2 \le 18$$
$$2x_2 + 5x_3 \le 10$$
$$3x_1 + 2x_2 + 4x_3 \le 15$$
$$x_1, x_2, x_3 \ge 0$$

3. What is transportation problem? A company has three warehouses W_1, W_2, W_3 and five stores S_1, S_2, S_3, S_4 and S_5. The availability of a given commodity at the warehouses is W_1 : 4; W_2 : 8; W_3 : 9. The demand at five stores are S_1 : 3, S_2 : 3; S_3 : 4; S_4 : 5 and S_5 : 6. The cost of shipping one unit of commodity from warehouse W_i to store S_j are as follows. Find an optimum shipping schedule which minimize the total shipping cost.

optimum time T?

Job	:	J_1	J_2	J_3	J_4	J_5	J_6
Machine A	:	30	120	50	20	90	110
Machine B	:	80	100	90	60	30	10

Skeâ keâejKeeve ce 6 keâeÙee keâe mecheVe keâjevee n~ Fve keâeÙee keâe A leLee B ceMeevee hej AB ›eâce ce ekeâÙee peevee n~ oevee ceMeevee hej ueieve Jeeuee meceÙe ØelÙekeâ ceMeevee keâ eueÙe eoÙee nDee n~ Deehekeâe keâeÙee keâe mecheVe keâjve keâ eueÙe keâeÙee keâ ›eâce keâe Fme Yeeele leÙe keâjvee n ekeâ keâue ueieve Jeeuee meceÙe T keâce me keâce ne~ Ùen vÙevelece meceÙe keÙee neiee?

keâeÙe	:	J_1	J_2	J_3	J_4	J_5	J_6
ceMeeve A	:	30	120	50	20	90	110
ceMeeve B	:	80	100	90	60	30	10

9. What is the problem of dynamic programming? State Bellman's Optimality principle. Use dynamic programming problem to find the value of :

Maximize : $Z = y_1, y_2, y_3$

Subject to : $y_1 + y_2 + y_3 = 5$

$y_1, y_2, y_3 \geq 0$

ieele Øe›eâceve mecemÙee keÙee n? yeueceve keâ F°lecekeâjCe emeæevle keâe yeleeFS~ ieele Øe›eâceve mecemÙee keâe ØeÙeeie keâjle nÙe evecveeueeKele keâe ceeve evekeâeeueÙe :

cenòece keâeepeÙe : $Z = y_1, y_2, y_3$

peyeekeâ : $y_1 + y_2 + y_3 = 5$

$y_1, y_2, y_3 \geq 0$

reservation clerk can serve a customer in six minutes on an average with an exponentially distributed service time.

(i) What is the probability that the system is busy?

(ii) What is the average time spend in the system?

(iii) What is the average length of the queue and what is the number for customers in the system?

Skeâ nJeeF meie"ve keâe mLeeveeÙe MeeKee ce ekeâmee eoÙe ieÙe meceÙe hej Skeâ eueehekeâ keâeÙe hej nelee n~ eueehekeâ Ùee$ee Deejs#eCe SJe G[eve meceÙe keâe meÛeveeDee keâe keâeÙe keâjlee ekeâmee eoÙe ieÙe meceÙe ce Deeve Jeeue «eenkeâe keâe meKÙee, peyeekeâ Deeve keâe oj 8 Øeele leše ne, keâe hJeeÙemee yešve ceevele nÙe eueehekeâ Skeâ «eenkeâ keâe Deemeleve 6 eceveš ce meJee keâj mekeâlee n~ meeJeme keâe yešve SkemeheeveevMeÙeue ne lee :

(i) ØeCeeuee keâ JÙeJemle neve keâe ØeeeÙekeâlee keÙee n?

(ii) ØeCeeuee ce Skeâ «eenkeâ keâe KeÛe keâjve keâe Deemele meceÙe keÙee n?

(iii) keâleej keâe Deemele uecyeeF leLee keâleej ce «eenkeâe keâe meKÙee keÙee n?

Unit-III / FkeâeF-III

6. (a) Describe different components of network diagram. Explain briefly the rules of network construction.

veŠJekeâ eÛe$e keâ eJeeYeVe DeJeÙeJee keâe JeeCelle keâeepeÙe~ veŠJekeâ eÛe$e keâe yeveeve ce ØeÙeeie neve Jeeue eveÙecee keâe me#ehe ce yeleeFS~

(b) A project consists of a series of tasks labelled A, B, ..., H, I with the following relationship (W < X, Y means X and Y can not start until W is completed ; X, Y < W means W can not start until both X and Y completed) :

A < D, E; B, D < F; C < G; B, G < H; F, G < I.

Construct the network diagram.

Skeâ Øeepekeš keâ keâeÙee A, B, ... , H, I ce evecve mecyevOe n~ (W < X, Y keâ ceeve ekeâ X,Y Me¤ vene ne mekeâle peye lekeâ keâeÙe W heje vene ne peelee leLee X, Y < W keâ ceeve n ekeâ keâeÙe W leye lekeâ vene Me¤ ne mekeâlee peye lekeâ keâeÙe X Deej Y hej vene ne peele) :

A < D, E; B, D < F; C < G; B, G < H; F, G < I)

veŠJekeâ eÛe$e keâe mejÛevee keâeepeÙe~

7. A project schedule has the following characteristics :

Skeâ Ùeepevee meÛee keâ evecve ue#eCe n :

Activity (keâeÙe)	Duration (meceÙe)
1-2	3
1-4	2
1-5	2
2-3	4
4-7	4
4-6	7
5-6	4
3-8	2
7-8	5
6-9	6
8-9	3

(i) Draw an arrow diagram for this project.
Fme Ùeepevee keâe veŠJekeâ eÛe$e yeveeFS~

(ii) Calculate critical path and total project duration.
›eâeevlekeâ heLe SJe keâue Ùeepevee meceÙe evekeâeeueÙe~

Unit-IV / FkeâeF-IV

8. In a factory there are six jobs to be performed each of which should go through two machines A and B in the order AB. The processing timings (in hour) for the jobs on two machines are given. You are required to determine the sequence for performing the job that could minimize the total elapsed time T. What is the