keâeÙee keâ ›eâceekeâjCe keâe mecemÙee keâe JeCeve keâeepeS~ evecve Deekeâ[leeve ceMeevee M_1, M_2 SJe M_3 hej keâÚ keâeÙee keâ Øe›eâce meceÙe keâe yeleele n~ Øe›eâceCe keâe ›eâce $M_1M_2M_3$ n~ Jen ›eâce %eele keâeepeS pee keâeÙee keâe mecheVe keâjve ce ueieve Jeeue keâue meceÙe T keâe vÙevelece keâj~ keâue ueieve Jeeuee meceÙe leLee M_1, M_2 SJe M_3 keâe DeeF[ue meceÙe Yee evekeâeeueS~

Jobs keâeÙe	Processing times (in Minutes) (meceÙe (eceveše ce)		
	M_1	M_2	M_3
1	3	4	6
2	8	3	7
3	7	2	5
4	4	5	11
5	9	1	5
6	8	4	6
7	7	3	12

A (Printed Pages 8)

S-699

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

STATISTICS

Third Paper

(Operations Research)

Time Allowed : Three Hours] [Maximum Marks : 35

Note : Answer five questions in all. Question No. 1 is compulsory.Besides, attempt one question from each unit.

keâue heeÙe ØeMvee keâ Gòej oeepeS~ ØeMve me. 1 DeeveJeeÙe n~ Fmekeâ Deeleejkele ØelÙekeâ FkeâeF me Skeâ ØeMve keâeepeS~

1. (a) What is the problem of optimization?
F°leceekeâjCe keâe mecemÙee keÙee n?

(b) State the linear programming problem's standard and canonical forms.
jeKekeâ Øe›eâceve mecemÙee keâ standard SJe canonical ™hee keâe eueeKeS~

(c) Define basic solution. When does it becomes degenerate?
yeemekeâ nue keÙee n? Ùen [epevejš keâye nelee n?

(d) What is duality? State the fundamental theorem of duality.
ÉleJeeo keÙee n? ÉleJeeo keâe ceeeuekeâ emeæevle eueeKeS~

(e) What is queuing theory?
keâleej ØeCeeuee keÙee n?

(f) Define transient and steady state of a queuing system.
keâleej ØeCeeuee ce #eeCekeâ leLee eJemleej oMee keâe mecePeeFS~

(g) What are different costs involved in inventory control?
'FvJeCše keâvšeue' ce Fmleceeue neve Jeeue eJeeYeVe ceuÙee keâe yeleeFS~

(h) What is EOQ?
EOQ me Deehe keÙee mecePele n?

(i) Distinguish between PERT and CPM.
PERT leLee CPM ce Yeo keâeepeS~

(j) Define critical activity and Critical Path.
›eâeevlekeâ keâeÙe SJe ›eâeevlekeâ heLe keâe heejYeee<ele keâeepeS~

Unit-I / FkeâeF-I

2. Apply Simplex method to solve the following LPP.
emecheuekeme eJeeOe ØeÙeeie keâjle nS evecveeueeKele LPP keâe nue keâeepeS:

Unit-IV / FkeâeF-IV

8. (a) Explain Problem of Dynamic programming. State Bellman's optimality Principle.
ieele Øe›eâceve mecemÙee keâe mecePeeFS~ yeueceve F°lece emeæevle keâe eueeKeS~

(b) Derive an EOQ Formula for optimum production quantity so as to minimize the total average cost per unit time, lead time is zero, demand is uniform production is instantaneous and there are no shortages.
F°lece Glheeo cee$ee keâ eueS Skeâ Fkeveeecekeâ ueeš meeFpe me$e evekeâeeueS, pee keâue Deemele keâecele keâe keâce keâj peyeekeâ De«e meceÙe MevÙe n, ceeie Skeâ meceeve n, Glheeove leelkeâeeuekeâ n, keâeF keâcee vene n~

9. Describe the problem of Job Sequencing.
Following data are regarding the processing times of some jobs on three machines M_1,M_2, M_3. The order of processing is $M_1M_2M_3$. Determine the sequence that minimize the total elapsed time T to complete the following jobs. Also evaluate the total elapsed time and idle time of three machines M_1, M_2 and M_3.

Ware house / Factory	W_1	W_2	W_3	W_4	Factory Capacity
F1	19	30	50	10	7
F2	70	30	40	60	9
F3	40	8	70	20	18
Warehouse Requirement	5	8	7	14	34

Unit-II / FkeâeF-II

4. Obtain steady state equation for the model M/M/1:∞/FCFS. Describe the characteristics of the model. Write down the relationship between average queue length and average waiting time.

   M/M/1:∞/FCFS cee[ue keâ eueS steady state meceekeâjCe evekeâeeueS~ cee[ue keâe ceKÙe eJeMe<eleeS JeeCele keâeepeS~ Average queue length SJe Average waiting time cee pee mecyevOe n, Gme eueeKeS~

5. If the arrivals are completetly random and $\lambda\Delta t$ is the probability of a single arrival during a small interval of time Δt and if the probability of more than one arrival is negligible, Prove that the arrival follows the Poisson's Law.

   Ùeeo SjeFJeue heCeleÙee ÙeeÂeÛÚkeâ n SJe Skeâ ÚeŠ meceÙe Devlejeue Δt ce Skeâ SjeFJeue keâe ØeeeÙekeâlee $\lambda\Delta t$ n SJe Skeâ me DeeOekeâ SjeFJeue keâe ØeeeÙekeâlee veieCÙe n, lee emeæ keâeepeS ekeâ SjeFJeue keâe yeŠve hJeeÙemee neiee~

Unit-III / FkeâeF-III

6. What are the steps involved in CPM? The following table gives the activities in a construction project and other relevant information

   (a) Draw the activity network of the project.

   (b) Carry out network analysis for CPM.

   CPM keâe keâeÙeeevJele keâjve ce ØeÙeòeâ ceKÙe meeheeve yeleeFS~ evecve meejCee ce eveceeCe keâeÙe keâ Skeâ Øeepekeš keâ keâeÙee leLee Gmeme mecyeeOele DevÙe meÛeveeS oe nF n~

   (a) Øeepekeš keâ keâeÙee keâe veŠJekeâ eÛe$e yeveeFS~

   (b) CPM keâ eueS veŠJekeâ eJeMue<eCe keâeepeS~

Activity keäeÙe (i, j)	Normal time meeceevÙe mecÙe (days)	Crash time (days)	Normal cost meeceevÙe ceuÙe (Rs.)	Crash cost >äiMe ceuÙe (Rs.)
1-2	20	17	600	720
1-3	25	25	200	200
2-3	10	8	300	440
2-4	12	6	400	700
3-4	5	2	300	420
4-5	10	5	300	600
4-6	5	3	600	300
5-7	10	5	500	800
6-7	8	3	400	700

7. Describe different components of network diagram. Explain briefly the rules of network construction. Construct the network diagram comprising activities A,B,……., H,I. satisfying the following constraints. The notation x<y means x must be finished before y can begin.
veŠJekeâ eÛe$e keâ eJeeYeVe leŠkeâe keâe heejYeee<ele keâeepeS~ veŠJekeâ eÛe$e yeveeve ce ØeÙeeie neve Jeeue eveÙecee me#ehe ce meceâPeeFS~ A,B,……., H,I keâeÙee Jeeue veŠJekeâ eÛe$e keâe evecve Melee keâe heeueve keâjle nS yeveeFS~ x<y keâe leelheÙe n, ekeâ keâeÙe x, y keâ Me™ neve keâ henue Kelce ne peevee ÛeeenS~

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

Minimize : $z = x_1 - 3x_2 + 2x_3$

vÙevelece keâeepeS : $z = x_1 - 3x_2 + 2x_3$

Subject to the constraints :

peyeekeâ evecve ØeeleyevOe n :

$3x_1 - x_2 + 2x_3 \le 7$

$-2x_1 + 4x_2 \le 12$

$-4x_1 + 3x_2 + 8x_3 \le 10$

$x_1, x_2, x_3 \ge 0$

3. (a) What is transportation problem? Give its mathematical formulation.
heejJenve mecemÙee keÙee n? Fmekeâe ieeCeleeÙe me$e eueeKeS~

(b) A Company is spending Rs.1000 on transportation of its units to four warehouses from three factories. The supply and demand of unit with unit cost of transportation are given in the following table. What can be the maximum saving by optimal scheduling.
Skeâ keâchevee Dehevee FkeâeFÙee keâ leeve meÙe$ee me Ûeej JeÙejneGme lekeâ heejJenve hej 1000 ™ JÙeÙe keâj jne n~ FkeâeFÙee keâe heele leLee ceeie keâe evecveeueeKele leeeuekeâe ce heejJenve keâe FkeâeFueeiele keâ meeLe eoÙee ieÙee n~ F°lece eveÙeepeve Éeje DeeOekeâlece yeÛele keÙee ne mekeâlee n~