National Testing Agency

Question Paper Name :	Operations Research 30 Sep 2020 Shift 1
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Operations Research

Group Number :	1
Group Id :	89951469
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Show Attended Group? :	No
Edit Attended Group? :	No
Break time :	0
Group Marks :	100
Is this Group for Examiner? :	No

Operations Research-1

Section Id :	89951479
Section Number :	1
Section type :	Online
Mandatory or Optional :	Mandatory
Number of Questions :	20
Number of Questions to be attempted :	20

Section Marks :	20
Mark As Answered Required? :	Yes
Sub-Section Number :	1
Sub-Section Id :	899514101
Question Shuffling Allowed :	Yes

Question Number : 1 Question Id : 8995146144 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

Graphical method can be applied to solve an LPP when there is/are only

1. one variable
2. more than one variable
3. two variables
4. more than two variables

Options :

89951424269. 1

89951424270. 2

89951424271. 3

89951424272. 4

Question Number : 2 Question Id : 8995146145 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

In the optimal simplex table, $z_j - c_j = 0$ for a non-basic variable indicates

1. infeasible solution
2. alternative solution
3. unbounded solution
4. cycling

Options :

89951424273. 1

89951424274. 2

89951424275. 3

89951424276. 4

Question Number : 3 Question Id : 8995146146 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

If at least one of the basic variables is zero in Basic Feasible Solution (BFS) of an LPP then it is called

1. degenerate
2. non-degenerate
3. infeasible
4. unbounded

Options :

89951424277. 1

89951424278. 2

89951424279. 3

89951424280. 4

Question Number : 4 Question Id : 8995146147 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

If the dual problem has an unbounded solution, then primal problem has

1. unbounded solution
2. no feasible solution
3. feasible solution
4. none of 1, 2 and 3

Options :

89951424281. 1

89951424282. 2

89951424283. 3

89951424284. 4

Question Number : 5 Question Id : 8995146148 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

If any of the constraints in the primal problem be a perfect equality, then the corresponding dual variable is

1. always positive
2. always negative
3. equal to zero
4. unrestricted in sign

Options :

89951424285. 1

89951424286. 2

89951424287. 3

89951424288. 4

Question Number : 6 Question Id : 8995146149 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

Dual simplex method is applicable to the LPPs that start with

1. an infeasible solution
2. an infeasible but optimum solution
3. a feasible solution
4. a feasible and optimum solution

Options :

89951424289. 1

89951424290. 2

89951424291. 3

89951424292. 4

Question Number : 7 Question Id : 8995146150 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

The solution of the transportation problem with m origins and n destinations is *feasible* if the number of positive allocations is

1. $m+n$
2. mn
3. $m+n+1$
4. $m+n-1$

Options :

89951424293. 1

89951424294. 2

89951424295. 3

89951424296. 4

Question Number : 8 Question Id : 8995146151 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

To improve an initial BFS by Stepping Stone method, the number of loops required is

1. one
2. more than one
3. same as unoccupied cells
4. same as occupied cells

Options :

89951424297. 1

89951424298. 2

89951424299. 3

89951424300. 4

Question Number : 9 Question Id : 8995146152 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

An optimal solution of an assignment problem can be obtained only if

1. each row and column has only one zero element
2. each row and column has at least one zero element
3. the data are arranged in a square matrix
4. none of 1, 2 and 3

Options :

89951424301. 1

89951424302. 2

89951424303. 3

89951424304. 4

Question Number : 10 Question Id : 8995146153 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

The value of the game with the pay-off matrix $\begin{pmatrix} 1 & -1 \\ -1 & 1 \end{pmatrix}$ is

1. -1
2. 1
3. 0
4. 2

Options :

89951424305. 1

89951424306. 2

89951424307. 3

89951424308. 4

Question Number : 11 Question Id : 8995146154 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

While solving a $2 \times n$ game graphically, the extreme point of the envelop considered is

1. minimax point
2. maximin point
3. neither maximin point nor minimax point
4. both maximin point and minimax point

Options :

89951424309. 1

89951424310. 2

89951424311. 3

89951424312. 4

Question Number : 12 Question Id : 8995146155 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

In a 2 jobs and n machines problem, a line at 45^o on the graph represents

1. job 1 is idle
2. job 2 is idle
3. both jobs are idle
4. both jobs are under processing

Options :

89951424313. 1

89951424314. 2

89951424315. 3

89951424316. 4

Question Number : 13 Question Id : 8995146156 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

Best replacement age for machine is decided by the relation

1. $R_{n+1} > \Sigma F(n)/ v^{n-1} > R_n$
2. $R_{n+1} > \Sigma F(n)/ v^{n-1} < R_n$
3. $R_{n+1} < \Sigma F(n)/ v^{n-1} > R_n$
4. $R_{n+1} < \Sigma F(n)/ v^{n-1} < R_n$

Options :

89951424317. 1

89951424318. 2

89951424319. 3

89951424320. 4

Question Number : 14 Question Id : 8995146157 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

Economic Order Quantity (EOQ) is given by: (where c_1 = inventory carrying cost, c_3 = ordering cost, R = demand for the product)

1. $(2c_1/c_3)^{1/2}$
2. $(2c_1 R/c_3)^{1/2}$
3. $2c_3R/c_1$
4. $(2c_3R/c_1)^{1/2}$

Options :

89951424321. 1

89951424322. 2

89951424323. 3

89951424324. 4

Question Number : 15 Question Id : 8995146158 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

In queue designation (a/b/c) : (d/f), what does c represents

1. arrival pattern
2. service pattern
3. number of service channels
4. capacity of the system

Options :

89951424325. 1

89951424326. 2

89951424327. 3

89951424328. 4

Question Number : 16 Question Id : 8995146159 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

In PERT, the expected time is

1. $t_e = (t_o+4t_m+t_p)/6$
2. $t_e = (t_o+2t_m+t_p)/4$
3. $t_e = (t_o+t_m+t_p)/3$
4. $t_e = (t_o+3t_m+t_p)/5$

Options :

89951424329. 1

89951424330. 2

89951424331. 3

89951424332. 4

Question Number : 17 Question Id : 8995146160 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

The technique of Dynamic Programming was developed by

1. Taylor
2. Gilberth
3. Richard Bellman
4. Bellman and Clarke

Options :

89951424333. 1

89951424334. 2

89951424335. 3

89951424336. 4

Question Number : 18 Question Id : 8995146161 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

While applying the cutting-plane method, dual simplex is used to maintain

1. optimality
2. feasibility
3. both 1 and 2
4. none of 1, 2 and 3

Options :

89951424337. 1

89951424338. 2

89951424339. 3

89951424340. 4

Question Number : 19 Question Id : 8995146162 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

In a Non-linear Programming Problem (NLPP),

1. the objective function is non-linear
2. one or more constraints are non-linear
3. both 1 and 2
4. none of 1, 2 and 3

Options :

89951424341. 1

89951424342. 2

89951424343. 3

89951424344. 4

Question Number : 20 Question Id : 8995146163 Question Type : MCQ Option Shuffling : No Is Question Mandatory : No Correct Marks : 1 Wrong Marks : 0

Which of the following methods of solving a Quadratic Programming Problem (QPP) is based on modified simplex method ?

1. Wolfe's method
2. Beale's method
3. Frank-Wolfe method
4. Fletcher's method

Options :

89951424345. 1

89951424346. 2

89951424347. 3

89951424348. 4

Operations Research-2

Section Id :	89951480
Section Number :	2
Section type :	Offline

Mandatory or Optional :	Mandatory
Number of Questions :	7
Number of Questions to be attempted :	5
Section Marks :	30
Mark As Answered Required? :	Yes
Sub-Section Number :	1
Sub-Section Id :	899514102
Question Shuffling Allowed :	No

Question Number : 21 Question Id : 8995146164 Question Type : SUBJECTIVE
Correct Marks : 6

Define basic solution and basic feasible solution.
Solve the following LP problem by graphical method:
Max $z = 1.5x1 + 2.5x2$
subject to
$x1 + 3x2 \geq 3$
$x1 + x2 \geq 2$
$x1, x2 \geq 0.$

Question Number : 22 Question Id : 8995146165 Question Type : SUBJECTIVE
Correct Marks : 6

Define a convex set. Show that the intersection of two convex sets is a convex set.

Question Number : 23 Question Id : 8995146166 Question Type : SUBJECTIVE
Correct Marks : 6

Determine an initial basic feasible solution to the following transportation problem using Vogel's approximation method:

Destination

		D_1	D_2	D_3	D_4	Supply
Source	S_1	11	13	17	14	250
	S_2	16	18	14	10	300
	S_3	21	24	13	10	400
	Demand	200	225	275	250	

Question Number : 24 Question Id : 8995146167 Question Type : SUBJECTIVE
Correct Marks : 6

Two competitors A and B are competing for the same product. Their different strategies are given in the following pay-off matrix:

Player B

Player A	B_1	B_2	B_3	B_4
A_1	3	2	4	0
A_2	3	4	2	4
A_3	4	2	4	0
A_4	0	4	0	8

Use dominance principle to find the optimal strategies of A and B.

Question Number : 25 Question Id : 8995146168 Question Type : SUBJECTIVE
Correct Marks : 6

Derive the optimal economic lot size formula

$$Q = \sqrt{\frac{2C_3DP}{C_1(P-D)}}$$

in the usual notations when the rate of replenishment is finite.
Also derive the formula for the minimum average cost of the production-inventory system.

Question Number : 26 Question Id : 8995146169 Question Type : SUBJECTIVE
Correct Marks : 6

Find the sequence that minimizes the total elapsed time required to complete the following tasks. Each job is processed in the order ACB.

		Job						
		1	**2**	**3**	**4**	**5**	**6**	**7**
Machines	**A**:	12	6	5	11	5	7	6
	B:	7	8	9	4	7	8	3
	C:	3	4	1	5	2	3	4

Also find the idle times for machines A, B and C.

Question Number : 27 Question Id : 8995146170 Question Type : SUBJECTIVE
Correct Marks : 6

In a railway marshaling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 minutes. Find (i) the average number of trains in the queue, (ii) probability that the queue size exceeds 10, and (iii) the expected waiting time in the queue.

Operations Research-3

Section Id :	89951481
Section Number :	3
Section type :	Offline
Mandatory or Optional :	Mandatory

Number of Questions :	7
Number of Questions to be attempted :	5
Section Marks :	50
Mark As Answered Required? :	Yes
Sub-Section Number :	1
Sub-Section Id :	899514103
Question Shuffling Allowed :	No

Question Number : 28 Question Id : 8995146171 Question Type : SUBJECTIVE
Correct Marks : 10

Solve by dual simplex method

$$\text{Minimize } z = 6x_1 + x_2$$
$$\text{Subject to } 2x_1 + x_2 \geq 3$$
$$x_1 - x_2 \geq 0$$
$$x_1, x_2 \geq 0.$$

Question Number : 29 Question Id : 8995146172 Question Type : SUBJECTIVE
Correct Marks : 10

Use Gomory's cutting plane method to solve the I.P.P.:

$$\text{Maximize } z = 4x_1 + 3x_2$$
$$\text{Subject to } x_1 + 2x_2 \leq 4$$
$$2x_1 + x_2 \leq 6$$
$$x_1, x_2 \geq 0 \text{ and are integers.}$$

Question Number : 30 Question Id : 8995146173 Question Type : SUBJECTIVE
Correct Marks : 10

Use Dynamic Programming to find the minimum value of

$z = y_1^2 + y_2^2 + \ldots + y_n^2$

subject to the constraints

$y_1 y_2 \ldots y_n = c \ (\neq 0)$,

$y_j \geq 0$ for $j = 1, 2, \ldots, n$.

Question Number : 31 Question Id : 8995146174 Question Type : SUBJECTIVE

Correct Marks : 10

A salesman has to visit five cities A, B, C, D, and E. The distances (in hundred miles) between the five cities are as follows:

		To				
		A	**B**	**C**	**D**	**E**
From	**A**	-	7	6	8	4
	B	7	-	8	5	6
	C	6	8	-	9	7
	D	8	5	9	-	8
	E	4	6	7	8	-

If the salesman starts from city A and has to come back to city A, which route should he select so that the total distance travelled is minimum.

Question Number : 32 Question Id : 8995146175 Question Type : SUBJECTIVE
Correct Marks : 10

A project has the following time schedule:

Activity	Time (months)	Activity	Time (months)
1-2	2	4-6	3
1-3	2	5-8	1
1-4	1	6-9	5
2-5	4	7-8	4
3-6	8	8-9	3
3-7	5		

Construct a network diagram and find the critical path and total project duration.

Question Number : 33 Question Id : 8995146176 Question Type : SUBJECTIVE
Correct Marks : 10

Use Kuhn-Tucker (KT) conditions to solve the following non-linear programming problem:

$$\text{Maximize } z = 2x_1 + x_2 - x_1^2$$
$$\text{Subject to } 2x_1 + 3x_2 \leq 6$$
$$2x_1 + x_2 \leq 4$$
$$x_1, x_2 \geq 0.$$

Question Number : 34 Question Id : 8995146177 Question Type : SUBJECTIVE
Correct Marks : 10

Use Beale's method to solve the QPP:

$$\text{Maximize } z = 2x_1 + 2x_2 - 2x_2^2$$
$$\text{Subject to } x_1 + 4x_2 \leq 4$$
$$x_1 + x_2 \leq 2$$
$$x_1, x_2 \geq 0.$$