Model Question Paper

Total Duration (H:M):3:00

Course: Operation Research (BMET-504)

Maximum Marks: 100

<table>
<tr><th>Q.No</th><th>Questions</th><th>Marks</th><th>CO</th><th>BL</th><th>PI</th></tr>
<tr><td>1a</td><td>What are the characteristics of Operation Research?</td><td>6</td><td>CO1</td><td>L1</td><td></td></tr>
<tr><td>1b</td><td>Discuss the practical applications of Transportation and Assignment Problem.</td><td>6</td><td>CO2</td><td>L2</td><td></td></tr>
<tr><td>1c</td><td>How degeneracy is resolved in Simplex method? Explain.</td><td>8</td><td>CO2</td><td>L2</td><td></td></tr>
<tr><td>2a</td><td>Explain following terms used in PERT (i) Pessimistic time (ii) Optimistic time (iii) Most likely time.</td><td>6</td><td>CO5</td><td>L1</td><td></td></tr>
<tr><td>2b</td><td>Explain the Maximin-Minimax principle used in game theory.</td><td>6</td><td>CO4</td><td>L2</td><td></td></tr>
<tr><td>2c</td><td>Solve the following LPP using Simplex method:
Maximize $Z = 4X_1 + 5X_2 - 3X_3$
Subject to $X_1 + X_2 + X_3 = 10$
$X_1 - X_2 \geq 1$
$2X_1 + 3X_2 + X_3 \leq 30$
$X_1, X_2, X_3 \geq 0$</td><td>8</td><td>CO2</td><td>L5</td><td></td></tr>
<tr><td>3a</td><td>Form the dual of the following primal problem.
Minimize $Z=20X_1 + 40X_2$
Subject to $2X_1 + 20X_2 \geq 40$
$20X_1 + 3X_2 \geq 20$
$4X_1 + 15X_2 \geq 30$
X_1 and $X_2 \geq 0$</td><td>6</td><td>CO2</td><td>L2</td><td></td></tr>
<tr><td>3b</td><td>Explain the procedure of Simplex method to solve a linear programming problem.</td><td>6</td><td>CO2</td><td>L2</td><td></td></tr>
<tr><td>3c</td><td>Solve by the dual simplex method the following LPP.
Minimize $Z = 5X_1 + 6X_2$
Subject to $X_1 + X_2 \geq 2$
$4X_1 + X_2 \geq 4$
$X_1, X_2 \geq 0$</td><td>8</td><td>CO2</td><td>L5</td><td></td></tr>
<tr><td>4a</td><td>Explain MODI method as applied to transportation problem giving example.</td><td>6</td><td>CO2</td><td>L2</td><td></td></tr>
<tr><td>4b</td><td>Find only initial solution to the problem given below by VAM method.
DESTINATIONS
<table><tr><td></td><td>D1</td><td>D2</td><td>D3</td><td>D4</td><td>SUPPLY</td></tr><tr><td>ORIGIN O1</td><td>4</td><td>6</td><td>8</td><td>13</td><td>50</td></tr><tr><td>ORIGIN O2</td><td>13</td><td>11</td><td>10</td><td>8</td><td>70</td></tr><tr><td>ORIGIN O3</td><td>14</td><td>4</td><td>10</td><td>13</td><td>30</td></tr><tr><td>ORIGIN O4</td><td>9</td><td>11</td><td>13</td><td>8</td><td>50</td></tr><tr><td>DEMAND</td><td>25</td><td>35</td><td>105</td><td>20</td><td></td></tr></table></td><td>6</td><td>CO2</td><td>L5</td><td></td></tr>
<tr><td>4c</td><td>At a car service centre, cars arrive according to Poisson process with mean 3 per hour. The time for servicing each car is exponentially distributed with mean 15 minutes per car. The</td><td>8</td><td>CO4</td><td>L5</td><td></td></tr>
</table>

<table>
<tr><td></td><td>facility can handle 1 car at a time. Compute: (i) Average queue length (ii) Average number of cars in the queuing system (iii) Waiting time in the system and (iv) Percent utilization of service.</td><td></td><td></td><td></td><td></td></tr>
<tr><td>5a</td><td>Explain various basic steps in PERT/CPM techniques.</td><td>6</td><td>CO4</td><td>L2</td><td></td></tr>
<tr><td>5b</td><td>At a car service centre, cars arrive according to Poisson process with mean 3 per hour. The time for servicing each car is exponentially distributed with mean 15 minutes per car. The facility can handle 1 car at a time. Compute: (i) Average queue length (ii) Average number of cars in the queuing system (iii) Waiting time in the system and (iv) Percent utilization of service.</td><td>6</td><td>CO4</td><td>L5</td><td></td></tr>
<tr><td>5c</td><td>The owner of a small machine shop has four mechanics available to assign jobs for the day. Five jobs are offered with expected profit for each mechanic on each job which are as follows:
JOB
<table><tr><td></td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td></tr><tr><td>MECHANIC I</td><td>62</td><td>78</td><td>50</td><td>111</td><td>82</td></tr><tr><td>MECHANIC II</td><td>71</td><td>84</td><td>61</td><td>73</td><td>59</td></tr><tr><td>MECHANIC III</td><td>87</td><td>92</td><td>111</td><td>71</td><td>81</td></tr><tr><td>MECHANIC IV</td><td>48</td><td>64</td><td>87</td><td>77</td><td>80</td></tr></table>Find by using the assignment method, the assignment of mechanics to the job that will result in maximum profit. Which job should be declined?</td><td>8</td><td>CO2</td><td>L5</td><td></td></tr>
<tr><td>6a</td><td>Assuming that the expected times are normally distributed find the probability of meeting the schedule date as given for the network.
<table><tr><td>Job</td><td>1-2</td><td>1-3</td><td>2-4</td><td>3-4</td><td>4-5</td><td>3-5</td></tr><tr><td>a (days)</td><td>2</td><td>9</td><td>5</td><td>2</td><td>6</td><td>8</td></tr><tr><td>m(days)</td><td>5</td><td>12</td><td>14</td><td>5</td><td>6</td><td>17</td></tr><tr><td>b(days)</td><td>14</td><td>15</td><td>17</td><td>12</td><td>12</td><td>20</td></tr></table>Scheduled project completion date is 30 days. Also find the date on which the project manager can complete the project with a probability of 0.90.</td><td>10</td><td>CO5</td><td>L5</td><td></td></tr>
<tr><td>6b</td><td>A small maintenance project consists of the following jobs whose precedence relationships is given below:
<table><tr><td>Job</td><td>1-2</td><td>1-3</td><td>2-3</td><td>2-5</td><td>3-4</td><td>3-6</td><td>4-5</td><td>4-6</td><td>5-6</td><td>6-7</td></tr><tr><td>Duration (Days)</td><td>15</td><td>15</td><td>3</td><td>5</td><td>8</td><td>12</td><td>1</td><td>14</td><td>3</td><td>14</td></tr></table>From the above information, you are required to:
(i) Draw an arrow diagram representing the project.
(ii) Find the total float for each activity.
(iii) Determine the critical path and total project duration.</td><td>10</td><td>CO5</td><td>L5</td><td></td></tr>
</table>