

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2024

Ph.D (All Branches)

COURSE CODE (CREDITS):18P1WGE101(03)

MAX. MARKS: 25

COURSE NAME: Research Methodologies Incl Quantitative Methods & Comp Applications

COURSE INSTRUCTORS: RKB,RAD,NKT

MAX. TIME: 1 Hour 30 Minutes

**Note:** (a) All questions are compulsory.

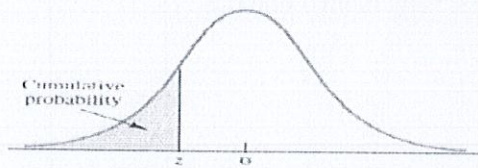
(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

Q.No	Question	Marks
Q1	<p>Answer the following questions:</p> <p>(a) Write the rotation matrix which will transform the vector <math>[1, 1]</math> to <math>[-1, 1]</math>.</p> <p>(b) For the following matrix <math>A</math>, if the eigenvalues are 4 and 8, then find the values of <math>x</math> and <math>y</math>:</p> $A = \begin{bmatrix} 2 & 3 \\ x & y \end{bmatrix}$ <p>(c) Find the Eigen values and Eigen vectors of matrix <math>\begin{pmatrix} 5 &amp; 3 \\ 3 &amp; 5 \end{pmatrix}</math></p>	6
Q2	<p>Investigate for what value of <math>\alpha, \beta</math> the simultaneous equations <math>x + y + z = 6, x + 2y + 3z = 10, x + 2y + \alpha z = \beta</math>, have</p> <p>(a) no solution (b) unique solution.</p>	3
Q3	<p>Genetic researchers are often interested in modeling the occurrence of rare mutations in populations. In a bioinformatics study, researchers are investigating a specific gene mutation that occurs with a probability of 0.05 in a certain population. Suppose they sample 50 individuals from this population.</p> <p>(a) What is the probability that exactly 3 individuals in the sample carry the gene mutation?</p> <p>(b) What is the expected number of individuals in the sample who carry the mutation?</p> <p>(c) Find the variance in the number of individuals who are expected to carry the gene mutation.</p>	4
Q4	<p>The time, <math>X</math>, in minutes, taken by the official staff to install a satellite dish may be assumed to be a normal random variable with <i>mean</i> 134 and <i>standard deviation</i> 16.</p> <p>(a) Determine <math>P(X &lt; 150)</math>.</p> <p>(b) Determine, to one decimal place, the time exceeded by 10 percent of installations.</p>	4



Q5	Solve the linear programming problem by Simplex method $\text{Max } Z = 7x_1 + 5x_2$ $\text{S/t } x_1 + 2x_2 \leq 6, 4x_1 + 3x_2 \leq 12$ $x_1, x_2 \geq 0$	[3]																																				
Q6	(a) Write the mathematical form of Assignment problem. (b) Solve the assignment problem <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Person/Job</th> <th>J1</th> <th>J2</th> <th>J3</th> <th>J4</th> <th>J5</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>20</td> <td>15</td> <td>18</td> <td>20</td> <td>25</td> </tr> <tr> <td>B</td> <td>18</td> <td>20</td> <td>12</td> <td>14</td> <td>15</td> </tr> <tr> <td>C</td> <td>21</td> <td>23</td> <td>25</td> <td>27</td> <td>25</td> </tr> <tr> <td>D</td> <td>17</td> <td>18</td> <td>21</td> <td>23</td> <td>20</td> </tr> <tr> <td>E</td> <td>18</td> <td>18</td> <td>16</td> <td>19</td> <td>20</td> </tr> </tbody> </table>	Person/Job	J1	J2	J3	J4	J5	A	20	15	18	20	25	B	18	20	12	14	15	C	21	23	25	27	25	D	17	18	21	23	20	E	18	18	16	19	20	[1+4]
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(Standard) Normal Probability Table:



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
-1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
-1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
-1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
-0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
-0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
-0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
-0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
-0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776