

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2025

Ph.D-I Semester (All Branches)

COURSE CODE (CREDITS): 18P1WGE101(03)

MAX. MARKS: 25

COURSE NAME: Research Methodologies Incl Quantitative Methods and Computer Applications

COURSE INSTRUCTORS: NKT

MAX. TIME: 1 Hour 30 Min

Note: (a) All questions are compulsory.

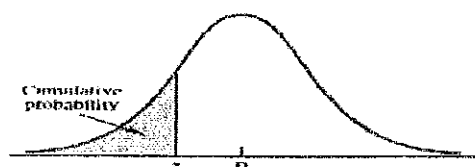
(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

(c) Scientific calculator is allowed

Q.No	Question	Marks
Q1	Public health researchers are studying the spread of a seasonal flu strain. In a large city, the probability that a randomly chosen individual has the flu during peak season is 0.08. Suppose researchers take a random sample of 40 individuals. (a) Define the <i>random variable</i> of interest for this problem. (b) What is the probability that exactly 5 individuals in the sample have the flu? (c) What is the expected <i>number of individuals</i> in the sample who have the flu? (d) Find the variance in the <i>number of individuals</i> who are expected to have flu.	4
Q2	The lifetime X, in hours, of a certain brand of LED bulb may be assumed to be a normal random variable with mean 1200 and standard deviation 180. (a) Determine $P(X > 1500)$. (b) Find the lifetime exceeded by 5% of the bulbs (correct to one decimal place).	4
Q3.	The ABC Company has been a producer of picture tubes for television sets and certain printed circuits for radios. The company has just expanded into full scale production and marketing of AM and AM-FM radios. It has built a new plant that can operate 48 hours per week. Production of an AM radio in the new plant will require 2 hours and production of AM-FM radio will require 3 hours. Each AM radio will contribute Rs.40 to profit while on AM-FM radio will contribute Rs.80 to profits. The marketing department, after extensive research, has determined that a maximum of 15 AM radios and 10 AM-FM radios can be sold each week. Formulate a linear programming model to determine the optimal production mix of AM and AM-FM radios that will maximize profit. Solve the problem using graphical method.	5

Q4.	Solve the LPP using Simplex method $\text{Max } Z = 2x_1 + 5x_2 + 7x_3$ $\text{s/t } 3x_1 + 2x_2 + 4x_3 \leq 100$ $x_1 + 4x_2 + 2x_3 \leq 100$ $x_1 + x_2 + 3x_3 \leq 100$ $x_1, x_2, x_3 \geq 0$	4
Q5.	Answer the following questions: (i) Write the rotation matrix which will transform the vector $\begin{bmatrix} 1 \\ -1 \end{bmatrix}$ anti-clockwise with an angle of 30 degrees. (ii) Explain the deformation impact of applying the matrix $\begin{pmatrix} 5 & 1 \\ 2 & 4 \end{pmatrix}$ on a circular ring with radius 1.	4
Q6	Investigate for what value of λ the simultaneous equations $3x - y + 4z = 3, x + 2y - 3z = -2, 6x + 5y + \lambda z = -3$, have (i) no solution (ii) a unique solution (iii) infinitely many solutions.	4

(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