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RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree in Information and Communication Technology
First Year - Semester I Examination – September/October 2019

ICT 1404 – Mathematics and Statistics for Computing

Time: Three (03) hours

- **Answer any FIVE (05) questions.**
- Calculators are allowed.
- Each question carries equal marks.
- Statistical tables and formulas are provided as attachments.

1. a) How many different words can be made using four (04) letters of the word 'REENGINEERING'? **(08 Marks)**

   b) A question paper has three parts A, B and C, each containing 5 questions. The particular two questions each from part A and part B must be selected.
   i. If a student needs to choose 3 questions from part A, 2 from part B and 2 from part C, in how many ways can he do that?
   ii. What would be the number of ways if particular two questions each from part A and part B must be selected? **(12 Marks)**

2. a) If $A+B=\begin{pmatrix}1 & 2\\ 5 & 4\end{pmatrix}$ where $A=\begin{pmatrix}1 & x+y\\ 3 & 5\end{pmatrix}$ and $B=\begin{pmatrix}1 & -2\\ y & 5\end{pmatrix}$.
   Find (i) x and y (ii) A^{-1}. **(08 Marks)**

   b) Using matrices or Cramer's rule solve the following linear equations.
   2x+3y+z=13, 5x+4y+3z=26, 9x-6y+7z=22
   (12 Marks)

3. a) A computer program generates three random questions in a test. The probability of the first question being answered correctly is 0.8. Whenever a question is answered correctly, the next question generated is more difficult, and the probability of the question being answered correctly is reduced by 0.1 otherwise the probability of the question being answered correctly remains unchanged. Find the probability that only two questions answered correctly.
   (08 Marks)

b) An employee travels to work by three routes A, B and C. The probabilities he choose those routes are respectively 0.6, 0.3 and 0.1. The probabilities that he is late for work if he go via route A, B and C respectively are 0.02, 0.04 and 0.05.

i. Find the probability he is late for work on Monday.

ii. Using the Bayes' theorem, find the probability he went through route A given that he was late.

(12 Marks)

4. a) At a supermarket, 60% of customers pay by credit cards. Find the probability that in a randomly selected sample of ten customers,

i. Exactly two customers pay by credit cards,

ii. More than eight customers pay by credit cards. **(10 Marks)**

b) On average the faculty computer network breaks down four times during a week (Monday to Friday). Assuming that the number of break downs can be modeled by a Poisson distribution, find the probability that it breaks down

i. Exactly once in a given week,

ii. At most two times on Friday. **(10 Marks)**

5. a) Cans of soups filled by a particular machine have volumes which are normally distributed with a mean 500ml and standard deviation 20ml.

i. Find the probability that the volume of a randomly selected can of soup is between 480ml and 510ml.

ii. 2% of the cans are rejected for being under-volume and 1% of the cans are rejected for being over-volume. Between what range of values should the volume of a can of soup lie if it is to be accepted?

(12 Marks)

b) The life expectancy of a bulb is exponentially distributed with mean, $\beta=400$ hours. Find the probability that a randomly selected bulb is last for more than 2000 hours if it is still working after 1200 hours. ($e^{-2}=0.135$)

(08 Marks)

6. The average trade-in value of a particular make of used Hybrid car depreciates with time according to the following table.

Age, x (years)	Value, Rs. (million)
2.0	6.10
2.5	5.55
3.0	5.09
3.5	4.65
4.5	3.89
5.0	3.51
6.0	3.31
7.0	2.50

a) Calculate the equation of line of regression of y on x using least square method. **(10 Marks)**

b) Estimate the value of the car when the age is 4 years. **(04 Marks)**

c) Compute the coefficient of Determination and interpret it. **(06 Marks)**

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Standard Normal Table for negative Z values

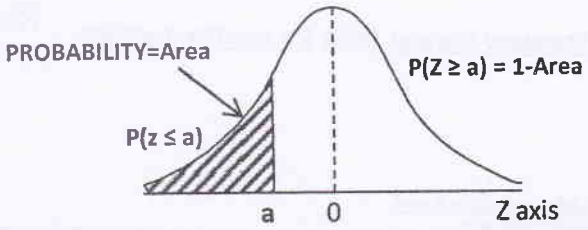

Table value =Area

TABLE A

Standard normal probabilities

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
−3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
−3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
−3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
−3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
−2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
−2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
−2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
−2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
−2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
−2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
−2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
−2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
−2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
−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
−0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
−0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
−0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
−0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

Standard Normal Table for positive Z values

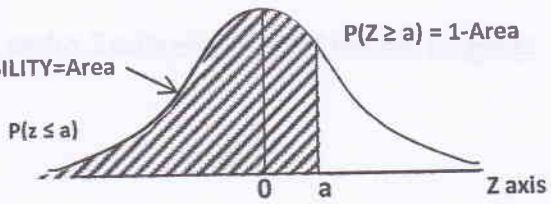

Table value =Area

TABLE B

Standard normal probabilities (continued)

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

Statistical Formulae

Probability Distributions

Normal distribution $Z = \frac{X - \mu}{\sigma}$, here μ = mean and σ = standard deviation

Binonmial distribution $P(x) = {}^{n}C_{x}p^{x}q^{n-x}$; here, q=1-p , x=0,1,2,...n

Poisson distribution $P(x) = \frac{e^{-\lambda}\lambda^{x}}{x!}$; here λ =mean=variance

Exponential distribution $P(x<T) = 1-e^{-\frac{T}{\beta}}$ or $P(x \geq T) = e^{-\frac{T}{\beta}}$ here β = mean

"no-memory property". P(x> a + b | x>a)=P(x>b)

Uniform distribution

$$P(x) = \frac{1}{b-a} \quad for \quad a < x < b$$
$$= 0 \quad elsewhere$$

Correlation and Regression Analysis

Karl Pearson's coefficient of correlaton, $r = \frac{n\sum xy - \sum x \sum y}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$

Line of regression, $y=a+bx$ where $b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$ $a = \bar{y} - b\bar{x}$

Coefficient of Determination, R $R^2 = b^2\left(\frac{\sum x^2 - n\bar{x}^2}{\sum y^2 - n\bar{y}^2}\right)$ or $R^2 = b^2\left(\frac{n\sum x^2 - (\Sigma x)^2}{n\sum y^2 - (\sum y)^2}\right)$

$R^2=r^2$