KATHMANDU UNIVERSITY
End Semester Examination
August, 2019

Mark Scored:

Level : B.Arch.
Year : I

Course : MATH 106
Semester: II

Exam Roll No. :

Time: 30 mins

F. M. : 20

Registration No.:

Date AUG 2 0 2019

SECTION "A"
[10Q × 1 = 10 marks]

Fill in the blanks space(s) by most appropriate word(s) or symbol(s).

1. The order of best scoring students in mathematics examination is an example of.....scale.

2. The temperature in degree Celsius is ..... scale.

3. If a software application developing company asks their users to rate the user friendly quality of this application as excellent, very good, good, and poor. This is an example of the.....scale.

4. Coefficient of variation of a random variable distributed as binomial with parameters n & p is .....

5. The central difference operator is denoted by .....

6. Every polynomial equation of the 6^{th} degree has ..... roots.

7. For the given distributed data find the value of $\Delta^3 y_0$ is?

x	3.60	3.65	3.70	3.75
y	36.598	38.475	40.447	42.521

8. If the parameter of a binomial distribution are n & p, then its standard deviation is .....

9. $\Delta^2 x^3 =$ .....

10. The example of a continuous data is .....

SECTION "B"
[10Q × 1 = 10 marks]

Choose and encircle the most appropriate answer from the given choices.

11. The shifting operator is denoted by _____.
a. E b. D c. μ d. Δ

12. The process of finding the values inside the interval (X_0, X_n) is called _____.
a. Interpolation b. Extrapolation
c. Iterative d. Polynomial equation

13. Newton forward interpolation formula is used for _____ intervals.
a. open b. unequal c. equal d. closed

14. Find $\Delta (x + \cos x)$?

a. $1+2\sin(x+1/2).\sin 1/2$ b. $1 -2\sin(x+1/2).\sin 1/2$

c. $1 -2\sin(x -1/2).\sin 1/2$ d. $1+2\sin(x -1/2).\sin 1/2$

15. By using Newton's backward difference table form the following data: $f(30) = 0.5000$, $f(35) = 0.5736$, $f(40) = 0.6428$, $f(45) = 0.7071$. What is the value of $\nabla^3 y_n$?

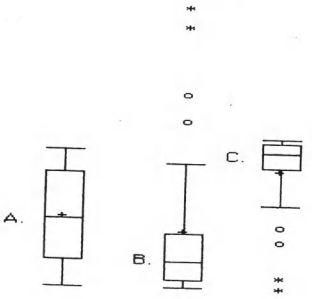
a. - 0.0049 b. -1.872 c. - 0.0005 d. -0.0469

16. The next iterative value of the root of $x^2 - 4 = 0$ using secant method, if the initial guesses are 3 and 4, is _____.

a. 2.2857 b. 2.5000 c. 5.5000 d. 5.7143

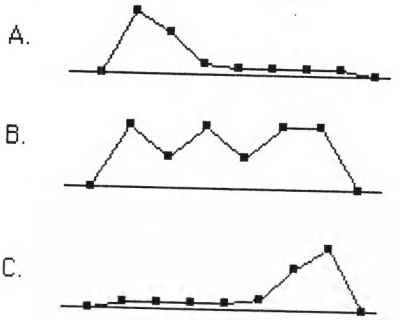
17. Box plots with a large positive skew is _____.

a. A b. B c. C d. None of these



18. Frequency polygon with a large negative skew is _____.

a. A b. B c. C d. None of these



19. The number of significant digits in the number 204.020050 is.....

a. 5 b. 6 c. 8 d. 9

20. If you had a z-score of -2.33 this would tell you that :.....

a. Your score was 2.33 standard deviations above the mean
b. Your score was 2.33 standard deviations below the mean
c. There was a probability of 2.33 of obtaining a score greater than your score
d. There was a probability of 2.33 of obtaining a score less than your score

KATHMANDU UNIVERSITY
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Level : B.Arch.
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Time : 2 hrs. 30 mins.

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F.M. : 55

SECTION "C"

[3Q. × 7 = 21 marks]

1. Elongation (in percent) of steel plates treated with aluminum is random with probability density function [2 + 2 + 1 + 2]

$$f(x) = \begin{cases} \frac{x}{250}, 20 < x < 30 \\ 0, \text{otherwise} \end{cases}$$

   a. What proportion of steel plates has elongation of greater than 25%?
   b. Find the mean elongation
   c. Find the variance of elongation
   d. Find the cumulative distribution function of the elongations

2. For the annual rainfall data in inches given below, do the following. [2 + 2 + 2 + 1]
   a. Construct the stem and leaf plot for these data and find the quartiles.
   b. Construct the histogram of these data
   c. Construct the box plot of these data
   d. Interpret the box plot

0.2	3.7	1.2	13.7	1.5	0.2	1.7
0.6	0.1	8.9	1.9	5.5	0.5	3.1
3.1	8.9	8.0	12.7	4.1	0.3	2.6
1.5	8	4.6	0.7	0.7	6.6	4.9
0.1	4.4	3.2	11.0	7.9	0.0	1.3
2.4	0.1	2.8	4.9	3.5	6.1	0.1

3. The life time of a battery in a certain application is normally distributed with mean $\mu = 16$ hours and standard deviation $\sigma = 2$ hours [1 + 2 + 2 + 2]
   a. Draw the shape of the probability distribution and find and represent the probability that a battery will have life time between 14.5 and 17 hours?
   b. Find the 10 th percentile of the life times.
   c. A particular battery last 14.5 hours. What percentile is its lifetime on?

SECTION "D"

[6Q. × 4 = 24 marks]

4. $p(x) = cx, x = 1, 2, 3, \text{or } 4$ where c is a constant.
   a. Find the value of the constant c so that p(x) is a probability mass function
   b. Find P(X=2)
   c. Find the cumulative distribution function of X

5. Prove that a) $\Delta = \mu\delta + \frac{\delta^2}{2}$ b) $\Delta^3 y_2 = \nabla^3 y_5$

6. The number of flaws in a certain type of lumber follows a poison distribution with a rate of 0.45 per linear meter. [2+2]
   a. What is the probability that a board of one meter has more than two flaws?
   b. How long must a board be so that the probability that it has no flaw is 0.5?

7. Given the equation $4e^{-x}sinx - 1 = 0$, find the root between 0 and 0.5 correct to three decimal places using Newton's Raphson's method.

8. Find the absolute error in the sum of the numbers 105.6, 27.28, 5.63, 0.1467, 0.000523, 208.5, 0.0235, 0.432 and 0.0467, where each number is correct to the digits given.

9. Find f(0.23) and f(0.29) from the following table using Newton's forward and backward difference formula [2+2]

x	0.20	0.22	0.24	0.26	0.28	0.30
y	1.6596	1.6698	1.6804	1.6912	1.7024	1.7139

SECTION "E"

[5Q. × 2 = 10 marks]

10. A pair of dice is rolled once. Let X be a random variable denoting the sum of the number appearing on the faces of these dice.
    a. What is the sample space of this experiment?
    b. What values does random variable X take?

11. If $p = 3c^6 - 6c^2$ find the percentage error in p at c=1, if the error in c is 0.05.

12. Find a real root of $f(x) = x^3 - 4x - 9$ correct to three decimal places using bisection method. Test till four iterations.

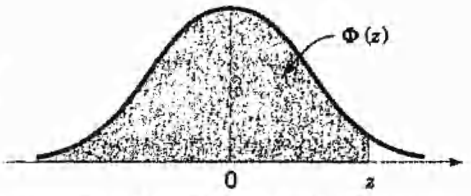
13. Find a real root of $f(x) = e^x - 3x$ correct to three decimal places using iteration method. Test till four iterations.

14. A continuous random variable X has the PDF f(x) = 2x if $0 \leq x \leq 1$. Find the cumulative distribution function (CDF) for X.

Table

Table I Cumulative Standard Normal Distribution *(continued)*

$$\Phi(z) = P(Z \leq z) = \int_{-\infty}^{z} \frac{1}{\sqrt{2\pi}} e^{\frac{-u^2}{2}} du$$



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	z
0.0	0.500000	0.503989	0.507978	0.511967	0.515953	0.519939	0.523922	0.527903	0.531881	0.535856	0.0
0.1	0.539828	0.543795	0.547758	0.551717	0.555760	0.559618	0.563559	0.567495	0.571424	0.575345	0.1
0.2	0.579260	0.583166	0.587064	0.590954	0.594835	0.598706	0.602568	0.606420	0.610261	0.614092	0.2
0.3	0.617911	0.621719	0.625516	0.629300	0.633072	0.636831	0.640576	0.644309	0.648027	0.651732	0.3
0.4	0.655422	0.659097	0.662757	0.666402	0.670031	0.673645	0.677242	0.680822	0.684386	0.687933	0.4
0.5	0.691462	0.694974	0.698468	0.701944	0.705401	0.708840	0.712260	0.715661	0.719043	0.722405	0.5
0.6	0.725747	0.729069	0.732371	0.735653	0.738914	0.742154	0.745373	0.748571	0.751748	0.754903	0.6
0.7	0.758036	0.761148	0.764238	0.767305	0.770350	0.773373	0.776373	0.779350	0.782305	0.785236	0.7
0.8	0.788145	0.791030	0.793892	0.796731	0.799546	0.802338	0.805106	0.807850	0.810570	0.813267	0.8
0.9	0.815940	0.818589	0.821214	0.823815	0.826391	0.828944	0.831472	0.833977	0.836457	0.838913	0.9
1.0	0.841345	0.843752	0.846136	0.848495	0.850830	0.853141	0.855428	0.857690	0.859929	0.862143	1.0
1.1	0.864334	0.866500	0.868643	0.870762	0.872857	0.874928	0.876976	0.878999	0.881000	0.882977	1.1
1.2	0.884930	0.886860	0.888767	0.890651	0.892512	0.894350	0.896165	0.897958	0.899727	0.901475	1.2
1.3	0.903199	0.904902	0.906582	0.908241	0.909877	0.911492	0.913085	0.914657	0.916207	0.917736	1.3
1.4	0.919243	0.920730	0.922196	0.923641	0.925066	0.926471	0.927855	0.929219	0.930563	0.931888	1.4
1.5	0.933193	0.934478	0.935744	0.936992	0.938220	0.939429	0.940620	0.941792	0.942947	0.944083	1.5
1.6	0.945201	0.946301	0.947384	0.948449	0.949497	0.950529	0.951543	0.952540	0.953521	0.954486	1.6
1.7	0.955435	0.956367	0.957284	0.958185	0.959071	0.959941	0.960796	0.961636	0.962462	0.963273	1.7
1.8	0.964070	0.964852	0.965621	0.966375	0.967116	0.967843	0.968557	0.969258	0.969946	0.970621	1.8
1.9	0.971283	0.971933	0.972571	0.973197	0.973810	0.974412	0.975002	0.975581	0.976148	0.976705	1.9
2.0	0.977250	0.977784	0.978308	0.978822	0.979325	0.979818	0.980301	0.980774	0.981237	0.981691	2.0
2.1	0.982136	0.982571	0.982997	0.983414	0.983823	0.984222	0.984614	0.984997	0.985371	0.985738	2.1
2.2	0.986097	0.986447	0.986791	0.987126	0.987455	0.987776	0.988089	0.988396	0.988696	0.988989	2.2
2.3	0.989276	0.989556	0.989830	0.990097	0.990358	0.990613	0.990863	0.991106	0.991344	0.991576	2.3
2.4	0.991802	0.992024	0.992240	0.992451	0.992656	0.992857	0.993053	0.993244	0.993431	0.993613	2.4
2.5	0.993790	0.993963	0.994132	0.994297	0.994457	0.994614	0.994766	0.994915	0.995060	0.995201	2.5
2.6	0.995339	0.995473	0.995604	0.995731	0.995855	0.995975	0.996093	0.996207	0.996319	0.996427	2.6
2.7	0.996533	0.996636	0.996736	0.996833	0.996928	0.997020	0.997110	0.997197	0.997282	0.997365	2.7
2.8	0.997445	0.997523	0.997599	0.997673	0.997744	0.997814	0.997882	0.997948	0.998012	0.998074	2.8
2.9	0.998134	0.998193	0.998250	0.998305	0.998359	0.998411	0.998462	0.998511	0.998559	0.998605	2.9
3.0	0.998650	0.998694	0.998736	0.998777	0.998817	0.998856	0.998893	0.998930	0.998965	0.998999	3.0
3.1	0.999032	0.999065	0.999096	0.999126	0.999155	0.999184	0.999211	0.999238	0.999264	0.999289	3.1
3.2	0.999313	0.999336	0.999359	0.999381	0.999402	0.999423	0.999443	0.999462	0.999481	0.999499	3.2
3.3	0.999517	0.999533	0.999550	0.999566	0.999581	0.999596	0.999610	0.999624	0.999638	0.999650	3.3
3.4	0.999663	0.999675	0.999687	0.999698	0.999709	0.999720	0.999730	0.999740	0.999749	0.999758	3.4
3.5	0.999767	0.999776	0.999784	0.999792	0.999800	0.999807	0.999815	0.999821	0.999828	0.999835	3.5
3.6	0.999841	0.999847	0.999853	0.999858	0.999864	0.999869	0.999874	0.999879	0.999883	0.999888	3.6
3.7	0.999892	0.999896	0.999900	0.999904	0.999908	0.999912	0.999915	0.999918	0.999922	0.999925	3.7
3.8	0.999928	0.999931	0.999933	0.999936	0.999938	0.999941	0.999943	0.999946	0.999948	0.999950	3.8
3.9	0.999952	0.999954	0.999956	0.999958	0.999959	0.999961	0.999963	0.999964	0.999966	0.999967	3.9