WEST BENGAL STATE UNIVERSITY
B.Sc. Honours 6th Semester Examination, 2021

STSADSE05T-STATISTICS (DSE3/4)

Time Allotted: 2 Hours   Full Marks: 40

The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.

Answer any *four* questions from Question Numbers 1-6 and any *two* questions from Question Numbers 7-9

1. Find a function whose first difference is $4x^3 + 2x + 5$.   5

2. In case of inverse interpolation, can you use Newton's interpolation formulae? If   5
    not, which interpolation formula can you use? Justify your answer.

3. If $u_x = a + bx + cx^2$, find a formula for $\int_0^1 u_x dx$ in terms of u_0, u_1 and u_2.   5

4. To find the solution of $x^3 + x^2 = 1$ by the method of iteration assuming an initial $2\frac{1}{2} + 2\frac{1}{2}$
    approximation of the root as $x_0 = 0.80$, justify which one of the following
    equation will be converted as $x = \varphi(x)$:

    (a) $x = (1 - x^2)^{\frac{1}{3}}$ (b) $x = (1 + x)^{-\frac{1}{2}}$

5. Write down the algorithm of numerical integration to evaluate $\int_{-\infty}^{0} x^2 e^x dx$.   5

    (You are permitted to draw random samples from $U(0, 1)$ only as many times as
    you want.)

6. If $X \sim \text{Bin}(n, 0.5)$, show that $P(X = \alpha n)$ is approximately $\dfrac{1}{\gamma^n \sqrt{2n\pi\alpha(1-\alpha)}}$ 5

    for large *n*, where α is a rational number and $\gamma = \alpha^\alpha (1-\alpha)^{1-\alpha}$.

7. (a) Find the eighth term of the sequence: 3, 14, 39, 84, 155, 258, …   5+5

   (b) Prove that the sum of the coefficients of y_0, y_1, … y_n in Lagrange's interpolation formula is unity.

8. (a) Suppose that the equation $x^2 + cx + d = 0$ has 2 real roots α and β. Show that the iteration process $x_{n+1} = -\dfrac{cx_n + d}{x_n}$ always converges to that root which has higher absolute value.   5+5

   (b) For the above equation in (a), find the iteration process using Newton-Raphson method and show that the process can converge to any one of the possible roots.

9. Describe any two methods of Monte Carlo integration to find $\displaystyle\int_{-1}^{1} \dfrac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}} dx$. Justify which one of these methods is better than the other. $(2\frac{1}{2} + 2\frac{1}{2})$ +5

N.B. : *Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.*

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