Roll Number:

Name:

Section:

Indian Institute of Information Technology, Sri City, Chittoor
Monsoon Semester Schedule Quiz 1, September-2025
UG2, First Sem

Name of the Exam: RANAC (S1) **Duration: 20 Minutes**

September 13, 2025 **Max. Marks:** 15

Instructions:

1. *Calculators are allowed.*
2. *All questions are mandatory and carry equal mark.*
3. *Tick only the right option. If we find two ticks for one question, '0' marks will be awarded.*
4. *Rough work should not be done in the question paper.*
5. *Return the question paper along with the rough sheet before leaving the exam hall.*

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1. **Let p, q be two real numbers such that $p > q > 0$. Define the sequence $\{x_n\}$ by**

$$x_1 = p + q, \qquad x_n = x_1 - \frac{pq}{x_{n-1}}, \quad n \geq 2.$$

Then, for all n, x_n is equal to one of the following:

(a) $x_n = \dfrac{p^{n+1} - q^{n+1}}{p^n - q^n}$

(b) $x_n = \dfrac{p^{n+1} + q^{n+1}}{p^n + q^n}$

(c) $x_n = \dfrac{(pq)^n}{p^n + q^n}$

(d) $x_n = \dfrac{(pq)^n}{p^n - q^n}$

Answer (a).

2. **Which of the following is/are incorrect?**

(i) Every subsequence of a non-convergent sequence is not convergent.

(ii) Every bounded sequence has a convergent subsequence.

(P.T.O.)

(iii) Every convergent sequence is a monotonic sequence.

(iv) Every convergent sequence of real numbers is bounded.

(a) (ii) & (iii)

(b) (iii) only

(c) (ii) only

(d) (i) & (iii)

Answer: (d)

3. **For $a_1 > 0$, the sequence $\{a_n\}$, where $a_{n+1} = 1 + \frac{1}{a_n},\ \forall\ n \geq 1$, converges to**

(a) $\dfrac{\sqrt{5}}{2}$

(b) $\dfrac{\sqrt{5}+1}{2}$

(c) $\dfrac{\sqrt{5}-1}{2}$

(d) $\dfrac{1}{\sqrt{5}}$

Answer (b).

4. **Let $A(n) = \displaystyle\int_n^{n+1} \frac{1}{x^3}\,dx$ for $n \geq 1$. For $c \in \mathbb{R}$, let $\lim_{n\to\infty} n^c A(n) = L$. Then**

(a) L = 0 if c > 3

(b) L = 1 if c = 3

(c) L = 2 if c = 3

(d) L = ∞ if 0 < c < 3

Answer (b).

5. **For $a, b \in \mathbb{N}$, consider the sequence**

$$d_n = \frac{\binom{n}{a}}{\binom{n}{b}}$$

for $n > a, b$; where $\binom{n}{r} = \frac{n!}{r!\,(n-r)!}, \quad 0 \leq r \leq n$. Which of the following statement is false? As $n \to \infty$

(a) $\{d_n\}$ converges for all values of a and b

(b) $\{d_n\}$ converges if $a < b$

(c) $\{d_n\}$ converges if $a = b$

(d) $\{d_n\}$ diverges if $a > b$

Answer (a).

6. $\{x_n\}, \{y_n\}, \{z_n\}$ **be sequences of real numbers,** $y_n = x_{2n}$ **&** $z_n = x_{2n+1}$ **then** $\{x_n\}$ **is convergent:**

   (a) if both $\{y_n\}$ and $\{z_n\}$ are convergent.

   (b) implies that both $\{y_n\}$ and $\{z_n\}$ are convergent.

   (c) implies that $\{z_n\}$ is convergent but $\{y_n\}$ does not need to be convergent.

   (d) implies $\{y_n\}$ is convergent but $\{z_n\}$ need not be convergent.

   Answer: (b)

7. **For which value of** b **does the ratio test guarantee convergence of series**

$$\sum_{n=1}^{\infty} \frac{(2n)!b^n}{(n!)^2}$$

   (a) $\frac{1}{10}$

   (b) $\frac{1}{2}$

   (c) $\frac{1}{3}$

   (d) 1

   Answer: (a)

8. **If** $\{a_n\}$ **be a sequence of positive numbers such that** $a_1 > a_2 > a_3 > \cdots$**. Then which of the following is true?**

   (a) $\lim_{n\to\infty} a_n = 0$

   (b) $\lim_{n\to\infty} \frac{a_n}{n} = 0$

   (c) $\sum_{n=1}^{\infty} \frac{a_n}{n}$ converges

   (d) $\sum_{n=1}^{\infty} n a_n$ converges

   Answer (b).

9. **The series**

$$\sum_{n=1}^{\infty} (-1)^{n+1} \left(\sqrt{n+1} - \sqrt{n}\right)$$

   (a) converges absolutely

   (b) converges conditionally

   (c) diverges

   (d) oscillatory

   Answer: (b)

10. **The power series** $\sum_{n=0}^{\infty} \frac{[2 + (-1)^n]^n}{3^n} x^n$ **converges**

(a) only for $x = 0$

(b) for all $x \in \mathbb{R}$

(c) only for $-1 < x < 1$

(d) only for $-1 < x \leq 1$

Answer (c).

11. **Let Δ denote the *forward difference operator*, then $\Delta {f_i}^2$ is equal to:**

(a) $(f_i - f_{i+1})\Delta f_i$

(b) $(f_{i+1} - f_i)\nabla f_i$

(c) $(f_i + f_{i+1})\Delta f_i$

(d) $(f_i + f_{i+1})\nabla f_i$

Answer: (c)

12. **Let ∇ and Δ denote the *backward difference operator* and *forward difference operator* respectively, then $\nabla - \Delta$?**

(a) $-\Delta\nabla$

(b) $\Delta\nabla$

(c) $-\Delta/\nabla$

(d) $-\nabla/\Delta$

Answer (a).

13. **If the Trapezoidal rule with single interval $[0, 1]$ is exact for approximating the integral**

$$\int_0^1 (x^3 - cx^2)\, dx.$$

Then c is equal to

(a) 1

(b) 5/2

(c) 3/2

(d) 2

Answer (c).

14. **Simpson's $\frac{1}{3}$ rule is used to integrate the function**

$$f(x) = \tfrac{9}{2}x^2 + 3x + 3$$

between $x = 0$ and $x = 1$ using the least number of equal sub-intervals. The value of the integral is

(a) 3

(b) $\dfrac{3}{2}$

(c) 6

(d) $\frac{9}{2}$

Answer (c).

15. **The coefficient of x^2 in the interpolating polynomial for the data**

x	**0**	**1**	**2**	**3**
$f(x)$	**1**	**2**	**1**	**4**

is

(a) 2

(b) -1

(c) -4

(d) 1

Answer: (c)

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