YASHWANTRAO CHAVAN MAHARASHTRA OPEN UNIVERSITY, NASHIK

(Estd. By Government of Maharashtra)
Dnyangangotri, Near Gangapur Dam, Govardhan, Nashik-422 222
Home Assignment

Academic Year - 2025 - 2026

Name of the Programme & Prog. Code	**Bachelor of Computer Applications(with Credits)-Blended Mode-2025 Pattern - NEP-YEAR - 1 Semester I & UGP05**		
Year / Semester	**Year - 1 / Semester I**		
Name of the Course & Course Code	**Mathematics (BCAC102)**		
Name of the Student	**YADAV DEEPANSHU RAJESH**		
Premanent Registration Number	**2507033500041496**		
Regional Centre	**Y.C.M.OPEN UNIVERSITY REGIONAL CENTER MUMBAI & 3139A**		
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Name of the Study Centre & Code	**Zagdu Singh Charitable Trust's Thakur Shyamnarayan Degree College & 31509**		
Date of Submission	05/12/2025	**No of Pages**	09

General Instructions

1	Home assignment is useful for self-analysis of your preparation of the final examination and progress
2	Read all the questions and their marks in the home assignment carefully understand the Definitions and concepts properly
3	Read carefully the text, syllabus and summary related to home assignment.
4	Do not copy the points, matter from the text while writing home assignment mentions your one point /opinions whenever necessary
5	Your answer should include how you would apply the knowledge in real life situations
6	Use A4 size lined papers for writing home assignment by taking printout from this file only
7	Write each new answer on a different page.
8	Printed or typed answers are not allowed
9	The marks of Home assignment and corrective instructions will be sent after checking home assignment
10	Present the Home Assignment by following the instructions and rules. Read carefully all the instructions and rules before any correspondence or communication with the university
11	**For the programs under NEP 2020 Pattern each theory course of 4 credits its carry 30 marks, there are Two Home Assignments:** i) **Home Assignment 01 (HA01) is of Twenty marks** consisting of 2 Short Answer Questions carrying 5 marks each and 1 Long Answer Question of 10 marks. ii) **Home Assignment 02 (HA02) is of Ten marks** consisting of total 10 Objective Type Questions (MCQ) carrying 1 mark each.
12	**For each theory course of 2 credits, there is Only One Home Assignment of Fifteen Marks** consisting of 1 Short Answer Question of 5 marks and 1 Long Answer Question of 10 marks.
13	Student have to write the Home assignment 02 (MCQ) on separate page. Home Assignment 02 also to be uploaded along with Home assignment 01.

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Q.NO.

1. Using the principal of mathematical induction, Prove that $1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$ For all natural numbers n.

Solution : First check the base case where $n = 1$.

$$L.H.S = 1^2 + 2^2 + 3^2 + \dots + n^2$$

$$R.H.S = \frac{n(n+1)(2n+1)}{6}$$

$$\therefore R.H.S = \frac{1(1+1)(2\times 1+1)}{6}$$

$$= \frac{1\times 2\times 3}{6} = \frac{6}{6} = 1$$

$\therefore L.H.S = R.H.S$

The base case hold true.

Step 2 : Assume that the formula holds for $n = K$

i.e :- $1^2 + 2^2 + 3^2 + \dots + K^2 = \frac{K(K+1)(2K+1)}{6}$

Step 3 : Now we need to prove that the formula holds for $n = K+1$

$$L.H.S = 1^2 + 2^2 + 3^2 + \dots + K^2 + (K+1)^2$$

$$R.H.S = \frac{K(K+1)(2K+1) + (K+1)^2}{6}$$

$$= \frac{K(K+1)(2K+1) + 6(K+1)^2}{6}$$

$$= \frac{(K+1)[K(2K+1) + 6(K+1)]}{6}$$

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$$= (k+1)\left[\frac{2k^2 + k + 6k + 6}{6}\right]$$

$$= (k+1)\left[\frac{2k^2 + 7k + 6}{6}\right]$$

$$= (k+1)\left[\frac{2k^2 + 4k + 3k + 6}{6}\right]$$

$$= (k+1)\left[\frac{2k(k+2) + 3(k+2)}{6}\right]$$

$$= \frac{(k+1)(k+2)(2k+3)}{6}$$

R.H.S = Put $n = k+1$

$$= \frac{n(n+1)(2n+1)}{6}$$

$$= \frac{(k+1)(k+1+1)[2(k+1)+1]}{6}$$

$$= \frac{(k+1)(k+2)(2k+3)}{6}$$

Conclusion :-

Since both the L.H.S and R.H.S are equal, we have shown that if the formula hold for $n=k$ if also hold for $n = k+1$.

Here by the principal of mathematical induction, the formula is true for all natural no. n.

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2. Let $U = \{1,2,3 \ldots 10\}$, $A = \{x : x$ is a prime number less than $10\}$, and $B = \{2,4,6,8,10\}$.
Find (a) $A \cup B$ (b) $A \cap B$) (c) A^c (d) $B - A$.
also, represent $A \cap B$ using a venn diagram.

Solution : Here $A = \{2,3,5,7\}$

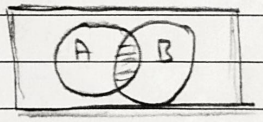
(a) $A \cup B$ (union) :-
Union means combine all elements of both sets without repeating.
$\Rightarrow \therefore A \cup B = \{2,3,4,5,6,7,8,10\}$

(b) $A \cap B$ (Intersection) :-
Intersection means common elements in both sets.
$\Rightarrow \therefore A \cap B = \{2\}$.

(c) A^c (Complement of A) :-
Complement means all elements in U that are not in A.
$\Rightarrow \therefore A^c = U - A = \{1,4,6,8,9,10\}$

(d) $B - A$ (Difference) :-
Difference means elements in B that are not in A.
$\Rightarrow \therefore B - A = \{2,4,6,8,10\} - \{2,3,5,7\}$
$= \{4,6,8,10\}$

$\therefore$ Venn diagram $A \cap B$

$\Rightarrow \therefore A \cap B \rightarrow$ 

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3. Simplify the following using law of logarithm

$\log_2 \left(\frac{64 \times \sqrt{32}}{16} \right)$ show all steps

Solution :

$\log_e (m \times n) = \log_e m + \log_e n$ — formula

$\log_e \left(\frac{m}{n}\right) = \log_e m - \log_e n$ — formula

$\therefore \log_2 (64 \times \sqrt{32}) - \log_2 16$

$\therefore \log_2 64 + \log_2 \sqrt{32} - \log_2 16$

$\therefore \log_2 2^6 + \log_2 (25)^{1/2} - \log_2 2^4 \rightarrow \log_2 2 = 1$

$\therefore 6 + \frac{5}{2_1} \overset{2.5}{} - 4$

$\therefore 6 + 2.5 - 4$

$\therefore 8.5 - 4$

$\therefore \underline{4.5} \rightarrow$ solution

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Q4. Solve following Multiple choice questions (MCQ).

1. Who is often referred to as the "Father of Computer"?
(a) Alan Turing (b) Charles Babbage (c) Kurt Godel
(d) John von Neumann
Answer : Option (b) Charles Babbage.

2. The first step in mathematical induction is :
(a) Assume the statement is true for $n = k$.
(b) Prove the statement for $n = k+1$
(c) Prove the statement for $n = 1$.
(d) Prove the statement for all n.
Answer : Option (c) Prove the statement for $n = 1$.

3. If $A = \{1, 2, 3\}$, what is the power set $P(A)$?
(a) $\{1, 2, 3\}$
(b) $\{\emptyset, \{1\}, \{2\}, \{3\}\}$
(c) $\{\emptyset, \{1\}, \{2\}, \{3\}, \{4\}, \{1,2\}, \{1,3\}, \{2,3\}, \{1,2,3\}\}$
(d) $\{1, 2, 3, \{1,2\}, \{1,3\}, \{2,3\}\}$
Answer : Option (c) $\{\emptyset, \{1\}, \{2\}, \{3\}, \{1,2\}, \{1,3\}, \{2,3\}, \{1,2,3\}\}$

4. $\log_2 32 = ?$

(a) 4 (b) 5 (c) 6 (d) 3

Answer : option (b) 5

$\Rightarrow \log_2 32 = \log_2 2^5 \quad (\log_{2^2} = 1)$
$= 5.$

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5. The binary equivalent of $(25)_{10}$ is :

(a) 11001_2 (b) 10101_2 (c) 10011_2 (d) 11100_2

Answer :- Option (a) 11001_2

2	25	1
2	12	0
2	6	0
2	3	1
2	1	1 ↑
	0	

$\therefore (11001)_2$

6. The number of permutations of 4 distinct object taken 2 at a time is :

(a) 6 (b) 12 (c) 24 (d) 8.

Answer :- Option (b) 12

⇒

formula : $P(n,r) = \frac{n!}{(n-r)!}$

where

- n is the total no of objects (4 in this case)
- r is the no. of objects taken at a time (2 in this case)

$\therefore P(4,2) = \frac{4!}{(4-2)!} = \frac{4 \times 3 \times 2 \times 1}{2} = \underline{12}$

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7. Which of following is a logical statement?
(a) what is your name? (b) $x + 5 = 10$
(c) It is raining (d) Both (b) and (c)

Answer : Option (d) Both (b) and (c)

A logical statement is a declarative sentence that is either true or false but cannot be simultaneously.

∴ (d) • $x + 5 = 10$
• It is raining

• "$x + 5 = 10$" This is a declarative mathematical sentence its truth value depends on the value of x in a logical content a statement with variable is predicate however once a value is assing to a.
Example :- If $x = 5$, it is true.
If $x = 4$, it is false

"It is raining" It is a declarative sentence that has definite truth at any given time and location

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8. A relation that is reflexive, symmetric and transitive is called.

(a) Equivalence relation
(b) Partial order
(c) Function
(d) Inverse relation

Answer :- Option (a) Equivalence relation

9. A function that is both one to one and onto is called :

(a) Injective
(b) Surjective
(c) Bijective
(d) Composite

Answer :- Option (c) Bijective.

10. If two vectors are perpendicular, their dot product is :
(a) 0 (b) 1 (c) -1 (d) Infinite

Answer :- Option (a) 0.

If two vector are perpendicular their dot product is zero. and for perpendicular vector the angle

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θ is 90° and the dot product formula

$A.B = |A||B| \cos\theta$

Result :- $A.B = |A|.|B| \cos 90^\circ \rightarrow (\cos 90^\circ = 0)$

$= |A|.|B| \, 0$

$= 0$

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