Set Theory & Algebra

Question 1

A binary operation $\oplus$ on a set of integers is defined as $x \oplus y = x^2 + y^2$. Which one of the following statements is TRUE about $\oplus$?

A Commutative but not associative

B Both commutative and associative

C Associative but not commutative

D Neither commutative nor associative

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Question 2

Consider the set S = {1, ω, ω2}, where ω and w^2 are cube roots of unity. If * denotes the multiplication operation, the structure (S, *) forms

A A group

B A ring

C An integral domain

D A field

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Question 3

Which one of the following in NOT necessarily a property of a Group?

A Commutativity

B Associativity

C Existence of inverse for every element

Existence of identity

D

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Question 4

Consider the binary relation R = {(x, y), (x, z), (z, x), (z, y)} on the set {x, y, z}. Which one of the following is TRUE?

A R is symmetric but NOT antisymmetric

B R is NOT symmetric but antisymmetric

C R is both symmetric and antisymmetric

D R is neither symmetric nor antisymmetric

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Question 5

For the composition table of a cyclic group shown below

*	a	b	c	d
a	a	b	c	d
b	b	a	d	c
c	c	d	b	a
d	d	c	a	b

Which one of the following choices is correct?

A a, b are generators

B b, c are generators

C c, d are generators

D d, a are generators

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Question 6

If P, Q, R are subsets of the universal set U, then
$(P \cap Q \cap R) \cup (P^c \cap Q \cap R) \cup Q^c \cup R^c$ is

A Q^c U R^c

B P U Q^c U R^c

C P^c U Q^c U R^c

D U

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Question 7

Let S be a set of nelements. The number of ordered pairs in the largest and the smallest equivalence relations on S are:

A n and n

B n^2 and n

C n^2 and 0

D n and 1

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Question 8

How many different non-isomorphic Abelian groups of order 4 are there

A 2

B 3

C 4

D 5

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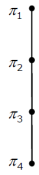
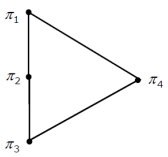
Question 9

Consider the set $S = \{a, b, c, d\}$. Consider the following 4 partitions $\pi_1, \pi_2, \pi_3, \pi_4$ on S: $\pi_1 = \{\overline{abcd}\}, \pi_2 = \{\overline{ab}, \overline{cd}\}, \pi_3 = \{\overline{abc}, \overline{d}\}, \pi_4 = \{\overline{a}, \overline{b}, \overline{c}, \overline{d}\}$. Let p be the partial order on the set of partitions $S' = \{\pi_1, \pi_2, \pi_3, \pi_4\}$ defined as follows: $\pi_i \mathrm{p} \pi_j$ if and only if π_i refines π_j. The poset diagram for (S', p) is:

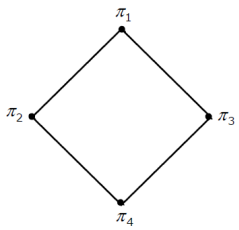
(A)



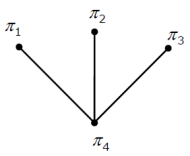
(B)



(C)



(D)



A A

B B

C C

D D

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Question 10

Consider the set of (column) vectors defined by
$X = \{x \in R^3 \mid x_1 + x_2 + x_3 = 0,$ where $x^T = [x_1, x_2, x_3]^T\}$. Which of the following is TRUE?
(A) $\{[1,-1,0]^T, [1,0,-1]^T\}$ is a basis for the subspace X.
(B) $\{[1,-1,0]^T, [1,0,-1]^T\}$ is a linearly independent set, but it does not span X and therefore is not a basis of X.
(C) X is not a subspace of R^3
(D) None of the above

A A

B B

C C

D D

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There are 115 questions to complete.

1 2 3 4 5 6 7 8 9 10 11 12

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