King Saud University
Department of Mathematics

151
Second Midterm, December 2015

NAME:

Group Number/Instructor Name:

ID:

Question	Grade
I	
II	
III	
IV	
Total	

Question	1	2	3	4	5
Answer					

I) Choose the correct answer (write it on the table above):

1) Which of the following is a partition of $\{1, 2, 3, 4, 5, 6, 7, 8\}$?

(A) $\{\{1\}, \{2, 4, 5\}, \{3, 5, 6, 7, 8\}\}$	(B) $\{\{1\}, \{2, 3, 7\}, \{4, 5, 6, 8\}\}$	(C) $\{\emptyset, \{1\}, \{2, 3, 7\}, \{4, 5, 6, 8\}\}$	(D) None of the previous

2) For the equivalence relation on $\mathbb{Z}$, defined by $aRb \iff a \equiv b(\mod 5)$,

(A) $11 \in [1]$	(B) $11 \in [0]$	(C) $11 \in [2]$	(D) None of the previous

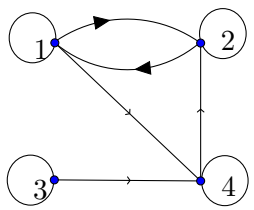
3) Let $G = (V, E)$ be an undirected graph with 3 vertices and 6 edges. If all vertices have the same degree, then $\forall\ v \in V$,

(A) $\deg(v) = 6$	(B) $\deg(v) = 4$	(C) $\deg(v) = 2$	(D) None of the previous

4) There exists a graph with vertices of degrees

(A) $1, 4, 2, 2$	(B) $1, 4, 2, 3$	(C) $1, 4, 1, 3$	(D) None of the previous

5) The relation R, defined on $\{1, 2, 3, 4\}$, whose graph is below, is



(A) symmetric	(B) transitive	(C) reflexive	(D) None of the previous

II) A) Let U be a nonempty set and R the relation defined on $\mathcal{P}(U)$ through

$$ARB \iff A \subseteq B, \quad \forall\ A, B \in \mathcal{P}(U).$$

Prove that $(\mathcal{P}(U), R)$ is a partially ordered set. Is it totally ordered? Justify your answer.

B) Let $A = \{1, 2, 3\}$ and $R = \{(1, 2), (2, 3), (3, 3)\}$. Determine the transitive closure R^*.

III) A) On $\mathbb{Z}$, define the relation R by

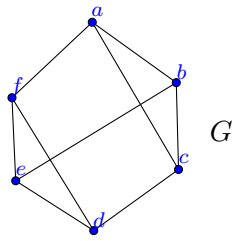
$$aRb \iff a - b \text{ is even.}$$

Prove that R is an equivalence relation.

B) Draw the Hasse diagram for the relation on the set $\{1, 2, 4, 5, 10, 20\}$, given by

$$aRb \iff a \text{ divides } b.$$

IV) A) Let G be the graph below.



i) Is G bipartite? Justify your answer.

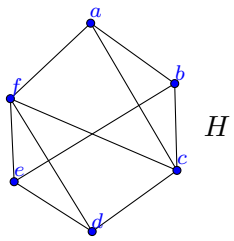
ii) Give a path that connects a and c. What is its length?

iii) Is G connected? Justify your answer.

iv) Find the degree of each vertex in the graph.

v) How many regions are there in the plane representation of G? Justify your answer. Draw a planar representation of G.

vi) Is the graph G a subgraph of the graph H represented below? Justify your answer.



B) Are the graphs M and N isomorphic? Justify your answer.