KING SAUD UNIVERSITY
College of Computer & Information Sciences
Muzahmyiah Branch

(Math 151) Discrete Mathematics
Fall Semester 2015/2016

Score

Second Midterm Exam

Date: 18/11/2015 Time: 11h30 – 13h00 Time allowed: 90 Minutes

STUDENT NAME(IN ENGLISH)	
Registration Number	
Lecture Time	

- There are **6** multiple choice questions **in part A** and **2** questions **in part B**. The maximum score is **20 marks.**
- Please do not forget to put your name and registration number on your paper.

Put your answers in the following table, please.

QUESTION	1	2	3	4	5	6
ANSWER	D	A	B	D	C	B

PART - A

1.5 $\times 6 = 9$

Q1. Let R be a relation on $\{1,2,3,4\}$ defined by $a\ R\ b \Leftrightarrow 2a-b=1$. Then R is:

A. $\{(1,1);(2,2);(3,3);(4,4)\}$

B. $\{(1,2);(2,3);(3,4)\}$

C. $\{(1,1);(1,3);(1,4)\}$

D. $\boxed{\{(1,1);(2,3)\}}$

Q2. The domain of the relation S defined on $\{1,2,3,4,5\}$ by $a\,S\,b \Leftrightarrow a^2 \mid b$ is

A. $\{1,2\}$
B. $\{2,4\}$
C. $\{1,2,4\}$
D. $\{1,2,3,4,5\}$

Q3. If R be a relation from $A=\{1,2\}$ to $B=\{3,4,5\}$ and S be a relation from B to $C=\{6,7\}$ represented by $M_R=\begin{pmatrix}1\,0\,1\\0\,1\,0\end{pmatrix}$ and $M_S=\begin{pmatrix}1\,0\\0\,1\\1\,0\end{pmatrix}$ respectively. Then $S \circ R$ is:

A. $A\times C$
B. $\{(1,6);(2,7)\}$
C. $\{(6,1);(7,2)\}$
D. $\{(2,6);(1,7)\}$

Q4. Let R be the relation defined on $\mathbb{Z}=\{0,\pm1,\pm2,...\}$ by $a\,R\,b \Leftrightarrow ab<0$. Then R is:

A. Antisymmetric and transitive
B. Antisymmetric and not transitive
C. Transitive and not antisymmetric
D. Not antisymmetric and not transitive

Q5. Let T be the equivalence relation defined on $\mathbb{Q}$ by $x\,T\,y \Leftrightarrow (x=y)\in\mathbb{Z}$. Then

A. $\left[\frac{1}{2}\right]=\left[\frac{5}{4}\right]$
B. $\frac{5}{4}\in\left[\frac{7}{2}\right]$
C. $\left[\frac{5}{4}\right]=\left[\frac{26}{8}\right]$
D. $\frac{5}{4}\notin\left[\frac{1}{4}\right]$

Q6. The transitive closure of $R=\{(a,c);(b,b);(c,b)\}$ defined on $\{a,b,c\}$ is:

A. $A\times A$
B. $\{(a,b);(a,c);(b,b);(c,b)\}$
C. $\{(a,c);(b,b);(c,b);(c,a);(b,c)\}$
D. $\{(a,c);(b,b);(c,b);(a,a);(c,c)\}$

PART –B

Q1 Let $R = \{(x, y) \mid \ |x - y| \leq 1\}$ and $S = \{(x, y) \mid 2x + y \leq 6\}$ be two relations defined on the set $A = \{1, 2, 3, 4\}$.

(**a**) List the elements of R and S. **2+2 Marks**

$R = \{(1,1); (2,2); (3,3); (4,4); (1,2); (2,3); (3,4); (2,1); (3,2); (4,3)\}$ 2

$S = \{(1,1); (1,2); (1,3); (1,4); (2,1); (2,2)\}$ 2

(**b**) Find M_R, M_S and $M_{R \circ S}$. **1+1+1 Marks**

$$M_R = \begin{pmatrix} 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 \end{pmatrix}$$ 1

$$M_S = \begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$ 1

$$M_{R \circ S} = M_S \odot M_R = \begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix} \odot \begin{pmatrix} 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 \end{pmatrix}$$

$$M_{R \circ S} = \begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}$$ 1

Q2. Let T be a relation defined on $A = \{1, 2, 3, 5, 6, 15\}$ by $x \; T \; y \Leftrightarrow \dfrac{x}{y}$ is odd.

(i) List the elements of T. **1 Mark**

$$T = \{ (1,1) ; (2,2) ; (3,3) ; (5,5) ; (6,6) ; (15,15) ; (3,1) ; (5,1) ; (15,1) ; (6,2) ; (15,3) ; (15,5) \}$$

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(ii) Show that (A, T) is a poset. **1 Mark**

- T reflexive because $I_A \subset T$
- T antisymmetric
- T transitive

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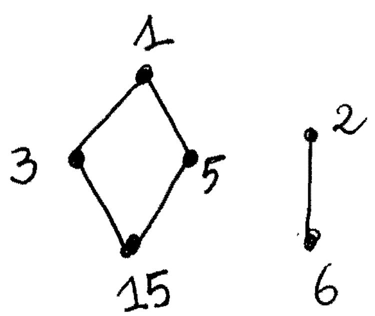
(iii) Is T a totally ordered relation on A ? Justify your answer. **1 Mark**

Not a tatally, because $2 \not T 5$ & $5 \not T 2$ 1

(iv) Draw the Hasse diagram. **1 Mark**



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