UTM UNIVERSITI TEKNOLOGI MALAYSIA

SCHOOL OF COMPUTING
Faculty of Engineering

SCSI1013: Discrete Structure
[2019/2020 - Semester 1]
Due Date: 17th October 2019

TUTORIAL 1.2

1. Let $A = \Re$ (real numbers). Give a description of the relation R on A specified by the shaded region in Figure 1.

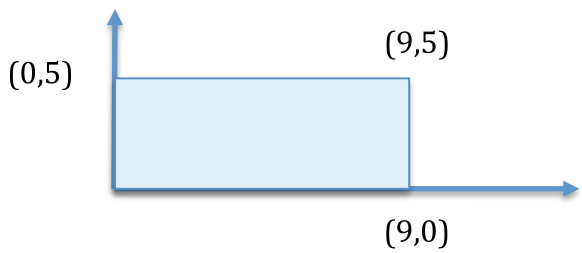

Figure 1

2. Let A = a set of people. Let $a\ R\ b$ if and only if a is the father of b; let $a\ S\ b$ if and only if a is the father of b. Describe $R \cup S$.

3. Let $D = \{1, 2, 3, 4, 5, 6\}$ and R be the relation on D whose matrix is

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

   Determine whether R is reflexive, irreflexive, symmetric, asymmetric, antisymmetric, or transitive.

4. In each part, sets A and B and a function from A to B are given. Determine whether the function is one to one or onto (or both or neither).

   a) $A = \Re \times \Re$. $B = \Re$; $f((a,b)) = a$ ($\Re$ - real numbers)

   b) Let $S = \{1,2,3\}$, $T = \{a,b\}$. Let $A = B = S \times T$ and let f be defined by $f(n,a)=(n,b)$, $n=1,2,3$ and $f(n,b) = (1,a)$, $n=1,2,3$.

5. One version of *Ackermann's function* $A(m,n)$ is defined recursively for $m,n \in N$ (natural numbers) by

   $A(0, n) = n+1, n \geq 0;$
   $A(m, 0) = A(m-1, 1), m > 0;$ and
   $A(m,n) = A(m-1, A(m, n-1)), m,n > 0$

   Calculate
   a) $A(1,3)$
   b) $A(2,3)$