

**SCSI1013: Discrete Structure**

**[2019/2020 - Semester 1]**

**Due Date: 17th October 2019**

**TUTORIAL 1.2**

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

(9,5)

(0,5)

(9,0)

 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* ∪ *S*.

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

 $M\_{R}=\left[\begin{array}{c}\begin{matrix}1&0&0\\0&1&1\\0&0&0\end{matrix} \begin{matrix}0&0&1\\0&1&0\\1&0&1\end{matrix} \\\begin{matrix}1&0&0\\0&0&1\\0&1&0\end{matrix} \begin{matrix}1&0&1\\0&1&0\\0&1&1\end{matrix} \end{array}\right]$

 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).

1. *A* = ℜ×ℜ. *B* = ℜ; *f*((*a,b*)) = *a* (ℜ - real numbers)
2. Let *S* = {1,2,3}, *T* = {a,b}. Let *A* = *B* = *S* × *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* ∈ *N* (natural numbers) by

 *A*(0, *n*) = *n*+1, *n*≥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

1. *A*(1,3)
2. *A*(2,3)