



SCSI1013: Discrete Structure
[2018/2019 - Semester 1]
Due Date: 14th October 2018

TUTORIAL 1

1. List the elements of the following sets and find the cardinality of each:
 - (a) $E = \{x : x = a^2, a \in \mathbb{N}, 3 < a < 7\}$
 - (b) $K = \{x : x \text{ is a prime number which is a divisor of } 42\}$
2. (a) Given $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{2, 4, 6, 8\}$, $B = \{1, 3, 4, 5, 7\}$, $C = \{7, 8\}$. Find the elements for the following set operations:
 - (i) $(A \cap C) \cap (A \cup B)$
 - (ii) $(A - B)'$
 - (iii) $D = \{x | x \in P((A \cup C)')\}$(b) Use properties of set to show that $(A \cap B') \cup (A \cap B) = A$.
3. Ninety people at a Superbowl party were surveyed to see what they ate while watching the game. The following data was collected:
 - 48 had nachos.
 - 39 had wings.
 - 35 had a potato skins.
 - 20 had both wings and potato skins. 19 had both potato skins and nachos.
 - 22 had both wings and nachos.
 - 10 had nachos, wings and potato skins.
 - (a) Use a Venn diagram to represent this data.
 - (b) How many had nothing?
4. Answer the following questions:
 - (a) Let x, y and z be integers, directly prove that if x divides y and x divides z then x also divides $y + z$.
 - (b) Are the statements "If I am not in Johor, then I am in Selangor", and "I am in Johor or I am not in Selangor" logically equivalent? (To answer this question, first convert them into symbolic statements.)
 - (c) Find the negation of the following statement (based on the propositions given) and state the truth value.

$p(x) : x \text{ is an even integer}$

$q(x) : x^2/x = 2$

$\exists x(p(x) \wedge q(x))$

5. Determine whether the relation R on set A is reflexive, irreflexive, symmetric, asymmetric, antisymmetric, or transitive.
 - a) $A = \mathbb{Z}$; $a R b$ if and only if $|a-b| = 2$ ($\mathbb{Z}$ is set of integers)
 - b) $S = \{1, 2, 3, 4\}$, $A = S \times S$; $(a,b) R (c,d)$ if and only if $ad=bc$.

6. Let $A = B = C = \mathbb{R}$, and let $f: A \rightarrow B$, $g: B \rightarrow C$ be defined by $f(a)=a-1$ and $g(b) = b^2$. Find:
 - a) $(f \circ g)(x)$
 - b) $(g \circ f)(x)$ ($\mathbb{R}$ is a set of real numbers)

7. Let $f(x,y) = (2x-y, x-2y)$, $(x,y) \in \mathbb{R} \times \mathbb{R}$ ($\mathbb{R}$ is set of real numbers)
 - a) Show that f is one to one
 - b) Find f^{-1}

8. Let $A=\{0,1\}$. Give a recurrence relation for the strings of length n in A^* that do not contain 01.
 (A^* is the set of all string over A)

9. A game is played by moving a marker ahead either 2 or 3 steps on a linear path. Let c_n be the number of different ways a path of length n can be covered. Given,

$$c_n = c_{n-2} + c_{n-3}, c_1=0, c_2=1, c_3=1$$
 Write a recursive algorithm to compute c_n .