UTM UNIVERSITI TEKNOLOGI MALAYSIA
SCHOOL OF COMPUTING
Faculty of Engineering

SCSI1013: Discrete Structure
[2018/2019 - Semester 1]
Due Date: 4th October 2018

TUTORIAL 1

1. List the elements of the following sets and find the cardinality of each:

   (a) $E = \{x : x = a^2, a \in N, 3 < a < 7\}$
   (b) K = {x : x 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 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) $A = Z$; a R b if and only if $|a-b| = 2$ (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 $A = B = C = R$, and let f: $A \rightarrow B$, g: $B \rightarrow C$ be defined by $f(a)=a-1$ and $g(b) = b^2$. Find:
   a) (fog)(x)
   b) (gof)(x) (R is a set of real numbers)

7. Let $f(x,y) = (2x-y, x-2y)$, $(x,y) \in R \times R$ (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.