Tutorial 1

1) Using your own words, define formal methods in software engineering.

A variety of mathematical modeling techniques that are applicable to computer system design.

2) Formal methods in software engineering comprises of two roles; *formal specification* and *formal verification*. Differentiate *formal specification* from *formal verification.*

Formal specifications means well-formed statements which describe "what" the software system should do, not (necessarily) "how" the system should do it. a process of describing a system behavior and its desired properties by using mathematics to specify the desired properties of the system. Two activities of formal specification: Modelling and Design.

Formal verification means showing that our code will do what we intend. It can also be defined to be the act of proving or disproving the correctness of some algorithm in a system with respect to a certain formal specification or property.

3) Formal methods are popular to be used for safety critical systems in software engineering. Discuss why formal methods are popular for this type of system.

4) For the industrial software development projects, formal methods were not very popular and were perceived as being difficult by many industrialists? What do you think would be the reasons? Discuss.

5) Use set display notation to describe the sets below:
   (a) the set of days you are timetabled to be in college
   {mon, tue, wed, thu, fri}
   (b) the set of digits used in base two arithmetic (binary)
   {0, 1, 01, 10, 001, 010, 011, 100}
   (c) the set of colours seen on a rainbow
   {red, orange, yellow, green, blue, violet, purple}

6) Which of the following expressions are true and which are false? Explain why.
   (a) end $\in$ {if, else, while, repeat, until, end} true
   (b) Key $\in$ {key, spaceKey, tabKey, returnKey, arrowKey, functionKey} false
   (c) -1 $\notin \mathbb{N}$ true
   (d) 3.142 $\in \mathbb{Z}$ false
   (e) -1 $\in \mathbb{N}$ false

7) Using set display notation enumerate (list) the contents of the sets defined below. If the set is too large to enumerate, then list just five elements from the set.
   (a) $\{ n: \mathbb{Z} \mid n \geq -1 \land n \leq 1\}$
   $n == \{-1, 0, 1\}$

   (b) $\{ n: \mathbb{Z} \mid n \geq -1 \land n \leq 1 \bullet n*n\}$
   $n == \{0,1\}$

(c) $\{ d: \mathbb{Z} \mid d \geq 1 \land d \leq 7 \}$
n == {1,2,3,...,7}

(d) $\{ n: \mathbb{Z} \mid n = 0 \lor n = 1\}$
n == {0,1}

(e) $\{ n: \mathbb{Z} \mid n \geq 0 \land n \bmod 10 = 0 \land n \operatorname{div} 10 \leq 10\}$
n == {0,10,20,...,100}