# Problem 1

A

1. What is a decision problem?

Answer: A problem with a "yes" or "no" answer

1. What does it mean to say that a decision problem belongs to NP?

Answer: It means a solution of problem can be verified is correct solution in polynomial time.

1. What is the Halting Problem?.

Answer: Is there a Java program(a Halting Calculator) which accepts as input a normal Java program R and an integer n (which we represent as a BigInteger), and which outputs 1 (or “true”) if R terminates normally when run on n, or else outputs 0 (“false”) if R does not terminate normally. [A “normal” Java program is one that has a public method that accepts a BigInteger argument and returns an Integer value]

1. What is a universal Java program?

Answer: A universal Java program accepts any normal Java program R, together with a BigInteger n, as inputs, and runs the method of R on n, and returns the value that R’s method returns.

B

Why is BigInteger used as an argument for the method of a normal Java program?

Answer: Because we need a Java data type that our program can be generalize and BigInteger can satisfy that. BigInteger has no limit, it depends on the memory of the computer.

C.

Answer:

Even though HaltingCalculator fails, it is conceivable that some other programs could work. We need to argue that any attempt to solve the Halting Problem will fail.

# Problem 4

It is true because

* T’ is T – {Sn - 1} and S’ = S – {Sn-1} so T’ still a sub set of S’
* The sum of elements in T’ now is oldSum – Sn-1 = k – Sn-1, even though there is only Sn-1 in T this is still correct (0 = 0)