一、(a) Given a sorted array of n elements (integer), please write a recursive binary search program (or a function). You can use any programming language or pseudo code. (10%)

(b) What's the time complexity of your program (in big-O notation with respective to n)? (3%)

二、(a) Use Kruskal's and Prim's algorithms, respectively, to find the minimum spanning tree of the graph on the right. (Draw the procedure step by step) (14%)

(b) What's the time complexity of Kruskal's and Prim's algorithms? (6%)

三、(a) What is the DeMorgan's rule? (3%)

(b) Please Prove DeMorgan's rule. (4%)

四、There is a hypothetical machine called SIC, for Single Instruction Computer. SIC has only one instruction `sbn`: subtract and branch if negative. The `sbn` instruction has three operands, each consisting of the address of a word in memory:

```
sbn a, b, c  /* Mem[a] = Mem[a] - Mem[b]; if (Mem[a] < 0) go to c */
```

The instruction will subtract the number in memory location b from the number in location a and place the result back in a, overwriting the previous value. If the result greater than or equal to 0, the computer will take its next instruction from the memory location just after the current instruction location. If the result is less than 0, then the next instruction is taken form memory location c. SIC has no registers, and no instructions other than `sbn`. For example, here is a program to copy a number from location a to location b.

```
start:  sbn temp, temp, .+1  /* Sets temp to zero
        sbn temp, a, .+1  /* Sets temp to -a
        sbn b, b, .+1  /* Sets b to zero
        sbn b, temp, .+1  /* Sets b to -temp, which is a
```

Please write a SIC program to add a and b, leaving the result in a and leaving b unmodified. (10%)

五、SQL Statement: (15%)

a. Define an SQL statement that inserts the movie `Armageddon` into the `Movie` table with the fields of "No,Movie_Name,Type, Limit".

b. Define an SQL statement that changes the address of Amy Stevens in the `Customer` table.

c. Define an SQL statement that deletes the customer with a `CustomerId` of 103.

六、Phone modems and digital subscriber lines (DSL) use the same kind of phone line to transfer data. Why is DSL so much faster than phone modems? Why do DSL and cable modem suppliers use technology that devotes more speed to downloads than to uploads? (15%)
What is the meaning of WSN? How to establish a physical WSN model to realize ubiquitous computing? (12%)

Using the forward chaining method to find new facts (8%)