Data Structures and Algorithms Laboratory | **DES-ITS 231**
Examination #1 Intro to Java For/While loop [Version 6]
Name Krittanut Yongsuphanomgko **ID** 6522770542 **Section** ?

Score 6/6

Please complete the following Java programs to generate the expected console output.

Problem 1: Printing Fibonacci Sequence

This program prints the Fibonacci sequence up to a given number 'n' ***using while loop***. The Fibonacci sequence is a series of numbers where each is the sum of the two preceding ones, typically beginning with 0 and 1.

```
public class Fibonacci {
  private static void printFibonacciSequence(int n) {
    int firstTerm = 0;
    int secondTerm = 1;
    int i = 1;
    while (i <= n)                                  { //Q1
      System.out.print(firstTerm + " ");
      int nextTerm = firstTerm + secondTerm;
      firstTerm = secondTerm                        ; //Q2
      secondTerm = nextTerm;
      i++                                           ; //Q3
    }
  }

  public static void main(String[] args) {
    printFibonacciSequence(10);
  }
}
```

(1) (1) (1)

This is the console output of the program when it is executed.

1 2 3 4 5 6 7 8 9 10

```
0 1 1 2 3 5 8 13 21 34
```

Problem 2: Printing a Sum Table

This program prints a sum table. The sum table displays each cell's sum of row and column indices using ***nested for loop***. Please complete the code and achieve the desired output.

```
public class SumTable {
  private static void printSumTable(int m, int n) {
    for(int i=0; i < m; i++)                        { //Q4
      for (int j = 0; j < n; j++) {
        System.out.print((i+j)+" ")                 ; //Q5
      }
      System.out.println();
    }
  }

  public static void main(String[] args) {
    printSumTable(6, 6)                             ; //Q6
  }
}
```

(1) (1) (1)

six five

This is the console output of the program when it is executed.

```
0 1 2 3 4
1 2 3 4 5
2 3 4 5 6
3 4 5 6 7
4 5 6 7 8
5 6 7 8 9
```

0,1,2,3,4
0,1,2,3,4,5

Seint

SIIT SINCE 1992

Data Structures and Algorithms Laboratory | DES-ITS 231
Examination #2 Recursion and Array [Version 6]
Name Kritthanut Yongsuphanmongkol ID 6522770 942 Section S

Score 6 5.5/6 TA Trust

Please complete the following Java methods and programs by filling in the blanks.

Problem 1

Please implement the integer array's `removeAtIndex(int index)` and `addLast(int e)` methods. The removeAtIndex(int index) method of an array is an operation that removes an element from the array at a specified index, shifting all subsequent elements to fill the gap created by the removal. The `addLast()` method appends or adds an element to the end of the array.

0 1 2 3 4 5 6
{1, 2, 3, 4, 0, 0, 0} i=4

1 2 3 4

```
int removeAtIndex(int index) {
  if (load > 0) {
    int temp = arr[index];

    for (int i=index; i < load - 1; i++) { // Q1
      int rightIndex = i + 1;
      if (rightIndex < size) {
        arr[i] = arr[rightIndex];
      }
    }
    arr[load-1] = 0;                     // Q2
    load--;                              // Q3
    return temp;
  } else {
    return 0;
  }
}

void addLast(int e) {
  if (load < size) {
    arr[load] = e;                       // Q4
    load++;
  }
}
```

Array
size: int load: int arr: int[]
addFirst(e: int): void addLast(e: int): void addAtIndex(e: int, index: int): void removeFirst(): int removeLast(): int removeAtIndex(index: int): int getElementAtIndex(index: int): int setElementAtIndex(e: int, index: int): void printArray(): void +main(args: String[]): void

Problem 2: Recursively calculates the sum of odd numbers

Using recursion, this Java program calculates the sum of odd numbers from a given positive integer from `n` to `1`. It performs this computation using a recursive function called `sumOfOdds(int n)`.

```
static int sumOfOdds(int n) {
    if (n <= 0) {
      return 0;                          // Q5
    } else {
      if (n % 2 != 0) {
        return n + sumOfOdds(n-1);       // Q6
      } else {
        return sumOfOdds(n - 1);
      }
    }
}
```

(n-2)

TA Trust

This is the console output of the program when ***sumOfOdds(10)*** *is executed from the* ***'main'*** *method.*

```
25
```

9
7
5
3
1

NKAN 1/1

SIIT SINCE 1992

Data Structures and Algorithms Laboratory | DES-ITS 231
Examination #3 Sorting and Hashing [Version 6]
Name Krittamut Yongsuphamongkol ID 6822770542 Section 5 .

Score 6/6

Please complete the following Java methods and programs by filling in the blanks. (10 Minutes) TA Tomat

Problem 1: Search a hash table that was previously filled with the folding hash function, and the collision was solved using quadratic probing.

Good job

```
int searchHashTableFoldingQuadratic(int key) {
   int C = 100;
   int orig_addr = (key % C + key / C) % hSize;
   int fi = 0 // or int addr = orig_addr ; // Q1
   int i = 0;
   while (H[addr] != key) {
      fi = i*i ; // Q2
      addr = (orig_addr + fi) % hSize; // Q
      i++ ; // Q3
   }
   return addr;
}
```

HashTable
H: int[] hSize: int
fillHashTableFoldingQuadratic (key: int): void searchHashTableFoldingQuadratic (key: int): int

Problem 2: Quick Sort

```
static void RecursiveQuickSort(int[] A, int start, int end) {
  if (start < end) {
     int pivot = A[end];
     int[] L = new int[A.length];
     int[] R = new int[A.length];
     int l_count = 0;
     int r_count = 0;
     for (int i = start; i < end; i++) {
       if (A[i] < pivot) {
          L[l_count] = A[i];
          l_count++;
       } else {
          R[r_count] = A[i];
          r_count++;
       }
     }

     for (int i = 0; i < l_count; i++) {
        A[start + i] = L[i] ; // Q4
     }
     A[start + l_count ] = pivot ; // Q5
     for (int i = 0; i < r_count; i++) {
       A[l_count + start + i + 1] = R[i];
     }
     RecursiveQuickSort(A, start, start + l_count - 1);
     RecursiveQuickSort(A, start + l_count + 1, start + l_count + r_count) ; // Q6
  }
}
```

G1

SIIT SINCE 1992

Data Structures and Algorithms Laboratory | DES-ITS 231
Examination #4 Slist [Version 6]
Name Krittamet Kongsuphamongkul **ID** 6622770542 **Section** 5.

Score 5.5/6

Please complete the following Java methods and programs by filling in the blanks.

Q1-Q5 Fill the result after running that line; Q6-Q8 Fill in the blank.

```
public class SlistV6 {
  public static void main(String[] args){
  SList<Integer> ilist = new SList<Integer>();
  ilist.addFirst(3);
  ilist.addLast(6);
  ilist.addFirst(3);
  ilist.printHorizontal();
  ilist.addAtIndex(4, 1);
  ilist.addLast(7);
  ilist.addAtIndex(1, 4);
  ilist.printHorizontal();
  System.out.println(ilist.removeAtIndex (5));
  System.out.println(ilist.removeFirst ());
  ilist.printHorizontal();
  }
}
```

3, 3, 6

3 3 6 / Q1 (0.5 point) 0.5

3, 4, 3, 6

3, 4, 3, 6, 7

3, 4, 3, 6, 1, 7

3 4 3 6 1 7 / Q2 (1 point) 1 0.5

7 / Q3 (0.5 point)

3 / Q4 (0.5 point) 0.5

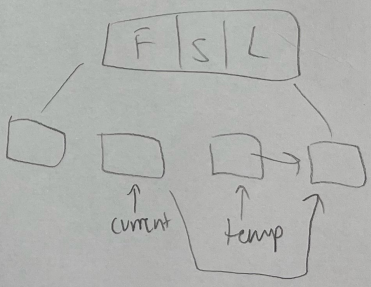
4 3 6 1 / Q5 (1 point) 1

```
//Class methods
  T removeAtIndex(int index){
    if(index < 0 || index > size)
      return removeLast(); /Q6 (0.5 point)
    else if(index==0)
      return removeFirst();
    else if(index==size-1)
      return removeLast();
    else {
      Node<T> current = first;
      for(int i=0; i < index-1; i++)
        current=current.next;

      Node<T> tmp = current.next /Q7 (1 point)

      current.next = tmp.next /Q8 (1 point)
      tmp.next=null;
      size--;
      return tmp.element;
  }
```

return null? ✗ 0



NYAN

G1

SIIT SINCE 1992

Data Structures and Algorithms Laboratory | DES-ITS 231
Examination #5 Stack and Application [Version 6]
Name Krittanut Tongsuphamongkol ID 6522770542 Section 5

Score 6/6

Please complete the following Java methods and programs by filling in the blanks.

```
static boolean isPalindrome(String word) {
Stack<Character> S1 = new Stack<Character>();
for (int i=0; i < word.length(); i++) {                    /Q1 (1)
    S1.push(word.AtChar[i]);                               /Q2 (1)
Stack<Character> S2 = S1.reverseStack();
while (!S1.isEmpty()) {
    if (S1.pop() != S2.pop()) {                            /Q3 (1)
        return false; }
}
return true;
}
```

word = word.toLowerCase(); ? 100%

or (!S1.pop().equals(S2.pop()))

```
void push(T element) {
    list.addFirst(T);                                      /Q4(0.5)  0.25
}
T pop() {
    return list.removeFirst();                             /Q5(0.5)  0.5
}
```

element

```
public class StackV6 {
  public static void main(String[] args){
    Stack<String> number = new Stack<String>();            /Q6 (1)
    number.push("77");
    number.pop();                                          /Q7 (0.5)  0.5
    number.push("12");
    System.out.println("Stack:"+number);
    number.push("13");                                     /Q8 (0.5)  0.5
    System.out.println("Stack:"+number);
    }
}
```

```
Stack:[12]
Stack:[12, 13]
```

NYAN

G1

SIIT SINCE 1992

Data Structures and Algorithms Laboratory | **DES-ITS 231**
Examination #6 Queue and Applications [Version 6]
Name Kritanut Yongsuphmongkol **ID** 6522770542 **Section** 5.

Score 6/6

Please complete the following Java methods and programs by filling in the blanks. (15 minutes)

```
97⊖   static void makeRoundRobin(Queue<Integer> Q, Queue<String> P, int limit, int resourceAmt)
98    {
99      printRoundRobin(Q, P, resourceAmt);
100
101     while(! Q.isEmpty() && resourceAmt!=0)
102     {    int temp =Q.dequeue();
103          String name = P.dequeue();
104          if( limit<=resourceAmt)
105          {  if(temp >= limit)
106            {
107
108             if(temp>0)
109             {   Q.enqueue(temp);
110                 P.enqueue(name);
111             }
112             printRoundRobin(Q, P, resourceAmt);
113            }
114          else
115          {
116              printRoundRobin(Q, P, resourceAmt);
117           }
118        }
119       else{  if(temp>resourceAmt)
120              {  temp=temp-resourceAmt;
121                 resourceAmt=0;
122                Q.enqueue(temp);
123                P.enqueue(name);
124              }
125              else
126              { resourceAmt=resourceAmt-temp;
127                temp=0;
128              }
129
130            printRoundRobin(Q, P, resourceAmt);
131     } //end if
132    }//end while
133   }
```

```
151   Queue<Integer> RRB = new Queue<Integer>();
152      RRB.enqueue(6);
153      RRB.enqueue(12);
154      RRB.enqueue(4);
155      RRB.enqueue(5);
156
157      RRB.enqueue(9);
158      Queue<String> P = new Queue<String>();
159      P.enqueue("P1");
160      P.enqueue("P2");
161      P.enqueue("P3");
162      P.enqueue("P4");
163      P.enqueue("P5");
164      P.enqueue("P6");
165      int amount = 40;
166      int quota = 3;
167      System.out.println("Your result is ");
168      QueueApp.makeRoundRobin(RRB, P, quota, amount );
169
170      System.out.println("The correct result should be ");
171      System.out.println(
172     "40: P1-6 P2-12 P3-4 P4-5 P5-7 P6-9 \n" +
173     "37: P2-12 P3-4 P4-5 P5-7 P6-9 P1-3 \n" +
174     "34: P3-4 P4-5 P5-7 P6-9 P1-3 P2-9 \n" +
175
176     "28: P5-7 P6-9 P1-3 P2-9 P3-1 P4-2 \n" +
177     "25: P6-9 P1-3 P2-9 P3-1 P4-2 P5-4 \n" +
178     "22: P1-3 P2-9 P3-1 P4-2 P5-4 P6-6 \n" +
179     "19: P2-9 P3-1 P4-2 P5-4 P6-6 \n" +
180     "16: P3-1 P4-2 P5-4 P6-6 P2-6 \n" +
181     "15: P4-2 P5-4 P6-6 P2-6 \n" +
182     "13: P5-4 P6-6 P2-6 \n" +
183     "10: P6-6 P2-6 P5-1 \n" +
184     "7: P2-6 P5-1 P6-3 \n" +
185     "4: P5-1 P6-3 P2-3 \n" +
186     "3: P6-3 P2-3 \n" +
187     "0: P2-3 ");
```

Q1 From Line No. 173 , the number 37 is calculated from source code line No? Complete the source code.

Answer 106: resourceAmt -= limit; (1) (0.5+0.5point)

Q2 P1-3 from Line No. 173 , the number 3 is calculated from source code line No?? Complete the source code.

Answer 107: temp -= limit; (1) (0.5+0.5point)

Q3 From Line No. 178➔179 , Why P1 is disappeared from queue? Which condition or which line made P1 disappear? Please explain. (1)

Answer
in the while loop when P1-3 it satisfy the if statement in line 104 and 105 then in line 107 temp is now 0 therefore the line 108 doesn't run therefore it didn't get enqueue back. (1 point)

Q4 From Line No. 180➔181 , Why the first number of row change from 16➔15? What line No. of source code used to calculate this new value? Complete the source code.

Answer Line 115: resourceAmt -= temp; (1) (0.5+0.5point)

Q5 Complete source code of Line No. 156 ? Answer RRB.enqueue(7); (1 point) (1)

Q6 Complete source code of Line No.175 (1)

"31: P4-5 P5-7 P6-9 P1-3 P2-9 P3-1 \n" + NYAN

SIIT SINCE 1992

Data Structures and Algorithms Laboratory | **DES-ITS 231**
Examination #7 Binary Tree [Version 6]
Name Kittanut Kongsuphanuwat **ID** 6522770542 **Section** 5 .

G1

Score 6/6

Complete the following method that is used to print a tree using breadth-first traversal in a binary tree class. This method should be implemented considering that '**root**' is a property of the class representing the root node, and it should be of type '**BTNode<T>**'. The UML of a '**Queue<T>**' class is provided below. (10 minutes)

Queue<T>
-list: SList<T>
Queue() enqueue(element: T): void dequeue(): T queuefront(): T queuerear(): T isEmpty(): boolean

```
public class BTNode<T> {
  T element;
  BTNode<T> left=null;
  BTNode<T> right=null;
  public BTNode(T e){
    element=e;
  }
}
```

```
void PrintBFT() {
  Queue<BTNode<T>> Q = new Queue<BTNode<T>>();
  Q.enqueue(root);                                    (1)
  BTNode<T> tmp;
  while(!Q.isEmpty())                                 (1) {
    tmp = Q.dequeue();                                (1)
    System.out.print(tmp.element)                     (1) + " ");
    if(tmp.left != null)                              (0.5)  /* 0.5 points */
      Q.enqueue(tmp.left);                            (0.5)  /* 0.5 points */
    if(tmp.right != null)                             (0.5)  /* 0.5 points */
      Q.enqueue(tmp.right);                           (0.5)  /* 0.5 points */
  }
  System.out.println();
}
```

Kevin

Data Structures and Algorithms Laboratory | **DES-ITS 231**
Examination #8 Binary Search Tree [Version 6]
Name Kritkamut Yongsuphamongkol **ID** 6527770547 **Section** 2.

Group 1

Score 6/6

Complete the following method that is used to delete a node in the binary search tree. (10 minutes)

```
public class BTNode<T> {
  T element;
  BTNode<T> left=null;
  BTNode<T> right=null;
  public BTNode(T e){
    element=e;
  }
}
```

```
public T delete(T item) {
  BTNode<T> parent = null;
  BTNode<T> current = root;
  boolean currentIsLeftChild = true;
  while (current != null) {
    if (item.compareTo(current) < 0 ){
      parent = current;
      current = current.left;
      currentIsLeftChild = true ;      /* 0.5 points */
    } else if (item.compareTo(current) > 0 ){
      parent = current;
      current = current.right;
      currentIsLeftChild = false ;     /* 0.5 points */
    } else {
      break ;
    }
  }
  // Case 0: item is not in the tree
  if (current == null) {
    return null;
  }
  T temp = current.element;
  // Case 1: current is the leave
  if (current.left == null && current.right == null) {
    if( currentIsLeftChild ){
      parent.left = null;
    } else {
      parent.right = null;
    }
  }
  // Case 2: If the deleted node has one child
  // Case 2.1: If its child node is on the right
  if (current.left == null) {
    if (currentIsLeftChild) {
      if (parent == null) {
        root = current.right;
      } else {
        parent.left = current.right;
        current.right = null;
      }
    } else {
      if (parent == null){
        root = current.right;
      } else {
        parent.right = current.right;
```

NYAN

```
            current.right=null;
          }
        }
      // Case 2.2: If its child node is on the left
      } else if (current.right == null) {
        if (currentIsLeftChild) {
            if (parent == null){
             root = current.left;
            } else {
              parent.left = current.left;
              current.left=null;
            }
        } else {
          if (parent == null)
            root = current.left;
          else {
            parent.right = current.left;
             current.left = null;
          }
        }
      } else {
        BTNode<T> maxleft = current.left;
        BTNode<T> maxleftParent = current;
        while (maxleft.right != null) {
          maxleftParent = maxleft;
          maxleft = maxleft.right;
        }
        current.element = maxleft.element;
        if (maxleft.left == null && maxleft.right == null) {
           maxleftParent.right=null;
        } else if (maxleft.left != null) {
           maxleftParent.right = maxleft.left;
           maxleft.left=null;
        } else if (maxleftParent == current) {
           current.left = maxleft.left;
           maxleft.left = null;
        }
      }
      size--;
      return temp;
    }
```

SIIT SINCE 1992

Data Structures and Algorithms Laboratory | DES-ITS 231

Examination #9 Heap [Version 6]

Name Krittanut Songsuphamongkol ID 6522770542 Section 5

G1

Score 4.5 / 6

There are 2 questions. [10 minutes]

1. Complete the following methods. The method **reheapUp(int i)** is used to restore the heap property by moving a newly added element up the heap to its correct position. The method **reheapDown(int i)** is used to restore the heap property by moving the element at the index **i** down the heap to its correct position. The method **insert(int data)** is used to insert a new data to the heap. The method **deleteRoot()** is used to delete the root of the heap. The method **makeHeapSort()** is used to print data in the heap from max to min.

```
void makeHeapSort() {
    while (load > 0) {
      System.out.print( deleteRoot() + " ");
    }
    System.out.println();
}
```

Heap
H: int[] load: int
Heap() reheapUp(i: int): void reheapDown(i: int): void insert(data: int): void deleteRoot(): int swap(H: int[], i1: int, i2: int): void

Heap UML

```
void reheapDown(int i) {
    int lastIndex = load - 1;
    if (2*i + 1 <= lastIndex) {
      int largeNodeIndex;
      int leftNodeIndex = 2*i + 1;
      int rightNodeIndex = 2*i + 2;
      if (rightNodeIndex > lastIndex) {
        largeNodeIndex = leftNodeIndex;
      } else if ( leftNodeIndex > lastIndex ) {
        largeNodeIndex = rightNodeIndex;
      }else {
        largeNodeIndex = lastIndex ;
      }
      if ( H[largeNodeIndex] > H[i] ) {
        swap(H, i, largeNodeIndex);
        reheapDown(largeNodeIndex);
      }
    }
}
```

if i <= 3

7

8

H[rightNodeIndex] > H[leftNodeIndex]

leftNodeIndex

Khaing

SIIT SINCE 1992

Data Structures and Algorithms Laboratory | **DES-ITS 231**
Examination #9 Heap [Version 6]
Name_____**ID**_____**Section**_____.

Score

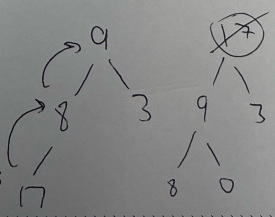
```
void swap(int[] A, int ind1, int ind2) {
    int temp = A[ind1];
    A[ind1] = A[ind2];
    A[ind2] = temp;
}
```

```
int deleteRoot() {
    int temp = H[0];
    if(load-1 >= 0) {
      H[0]= H[load-1];
      H[load-1] = 0;
      load--;
      reheapDown(0);
    }
    return temp;
}
```

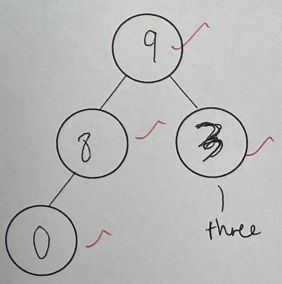
2. Draw the heap **H** in the binary tree structure after the following instructions are performed. (2 points)

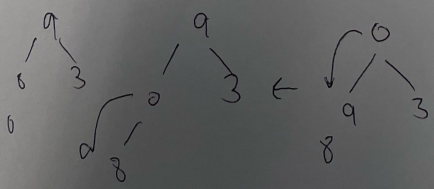
```
Heap H = new Heap();

H.insert(9);
H.insert(8);
H.insert(3);
H.insert(17);
H.insert(0);
H.deleteRoot();
```



Draw your final heap here.





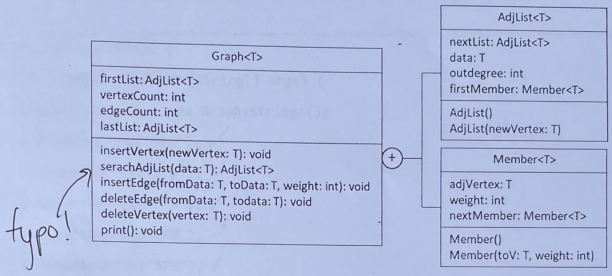
SIIT SINCE 1992

Data Structures and Algorithms Laboratory | **DES-ITS 231**
Examination #10 Graph [Version 3]
Name Krittanut Pongsuphamongkol **ID** 6522770342 **Section** 5

G1

Score

Please complete the following Java methods/programs and figure by filling in the blanks. (15 minutes)



6

```
void deleteEdge(T fromData, T toData) {
     AdjList<T> fromAdjList = searchAdjList(fromData);   (1 point)
     if (fromAdjList == null)  return;
     if (fromAdjList.firstMember != null &&
toData.equals(fromAdjList.firstMember.adjVertex)) {
        fromAdjList.firstMember = fromAdjList.firstMember.nextMember;   (1 point)
        edgeCount--;                                                    (1 point)
        fromAdjList.outdegree--;                                        (1 point)
     } else if (fromAdjList.firstMember != null
&& !toData.equals(fromAdjList.firstMember.adjVertex)) {
        Member<T> temp = fromAdjList.firstMember;
        while (temp != null && temp.nextMember != null) {
          if (temp.nextMember.adjVertex.equals(toData)) {
             temp.nextMember = temp.nextMember.nextMember;
             fromAdjList.outdegree--;
             edgeCount--;
          } else {  temp = temp.nextMember;}
        }
     }
}
```

SIIT SINCE 1992

Data Structures and Algorithms Laboratory | **DES-ITS 231**
Examination #10 Graph [Version 3]
Name_____**ID**_____**Section**_____.

Score

Assuming that graph **G** has been initially instantiated using the following code in the driver class. Please fill in the blank in the given code to complete the graph and fill in the blank of the graph figure (0.5 score each) in accordance with the code.

```
public class TestGraph {

  public static void main(String[] args) {

    Graph<String> G = new Graph<String>();
    G.insertVertex("BKK");
    G.insertVertex("NTB");
    G.insertVertex("PTH");
    G.insertVertex("CSD");
    G.insertVertex("SPK");
    G.insertVertex("SKN");
    G.insertVertex("NPT");
    G.insertEdge("NTB", "BKK", 70);
    G.insertEdge("PTH", "BKK", 120);
    G.insertEdge("CSD", "BKK", 190);
    G.insertEdge("SPK", "BKK", 80);
    G.insertEdge("SKN", "BKK", 170);
    G.insertEdge("NPT", "BKK", 85);
    G.insertVertex("SSM");
```

(0.5 point)

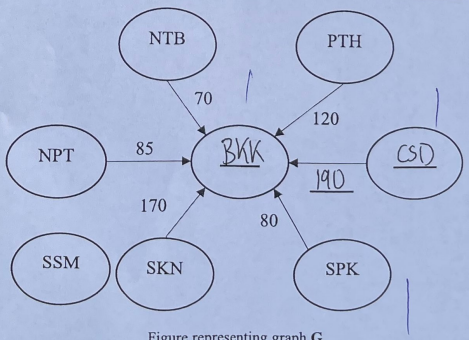


Figure representing graph **G**

(0.5 point x 3 = 1.5 in total)