QUEEN MARY AND WESTFIELD COLLEGE
DCS/115 INTRODUCTION TO PROGRAMMING

Class Test Wednesday 1st March 2000 09.05-10.35

Please fill in your name here: ....
College registration number here: ....
Email address here: ....Course Code here:..................

All answers to this test should be written on the test sheet, but you may use spare paper for rough working, or the space on the back page if you cannot fit your answers into the space provided. Answer as many of the questions as you can. This is an "open book" test: you are allowed to access your notes and textbook.

Part A

In this part, all questions refer to the example program distributed separately

Question 1

a) Give an example of a method which is a *constructor* by quoting the line numbers on which the method occurs (for example, if you think the method on lines 104-107 is a constructor, write *104-107*):

b) Give an example, by quoting its line numbers, of a method which *overrides* another method:

c) Give an example, by quoting its line numbers, of a method which *overloads* another method:

d) Give an example of an IS-A relationship between two classes:

e) Give an example of a HAS-A relationship between two classes:

f) Give an example of a mutable object class

g) Give an example of an immutable object class

Question 2

In this question, assume the following declarations and initialisations have been made:

```
Dragon puff = new Dragon("purple");
Dragon d1;
Monster m1, wyrm = new Monster(30,40,2);
Being fred = new Being(14,25);
Weapon excalibur = new Weapon("sword",50);
Weapon w1 = new Weapon("sword",20), w2 = new Weapon("spear",30);
Hero h1 = new Hero(50,100,200,"Arthur",excalibur);
Hero h2 = new Hero(30,200,150,"Merlin");
Hero h3;
```

In each part write what the code fragment will cause to be printed:

a)
```
System.out.println(excalibur);
```

b)
```
System.out.println(puff);
```

c)
```
System.out.println(h1);
```

d)
```
m1 = new Dragon("blue");
System.out.println(m1);
```

e)
```
h1.pickUp(w2);
System.out.println(h1);
```

f)
```
h3=h2;
h2 = new Hero(70,100,100,"Percival");
h2.pickUp(w2);
System.out.println(h3);
```

g) `System.out.println(fred.morale());`

h)
```
wyrm.attack(fred);
System.out.println(fred.morale());
```

i)
```
m1=wyrm;
Being wilma = new Being(12,20);
h1.attack(m1,w1);
wyrm.attack(wilma);
System.out.println(wilma.morale());
```

j)
```
d1 = new Dragon("red");
h3 = new Hero(40,50,70,"Bedivere");
d1.attack(h3);
System.out.println(h3.morale());
```

Question 3

Assuming the same declarations as in question 2, for each of the following code fragments, say whether it is valid or invalid Java, where "invalid Java" is code that will cause a compiler error or warning message when it is compiled:

	Valid/Invalid
a) `excalibur.hit(50,5);`	....
b) `wyrm.attack(fred,excalibur);`	....
c) `(new Hero(10,20,30,"Jim",w1)).pickUp(w2);`	....
d) `puff.attack(h2);`	....
e) `h3 = fred;`	....
f) `wyrm = (Monster) fred;`	....
g) `System.out.println(puff.morale());`	....
h) `System.out.println(puff.attack(h1));`	....
i) `if(wyrm instanceof Dragon)` `wyrm.attack(h1);`	....
j) `h3 = new Hero(40,50,35,"tom",new Weapon(10));`	....

Question 4

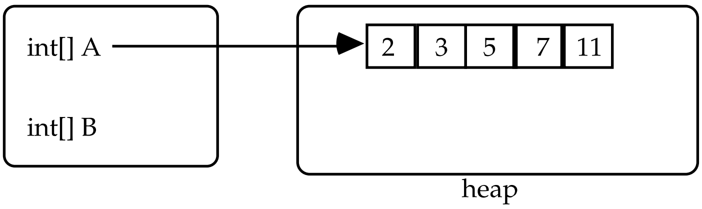
a) A magic weapon is a weapon that has the effect of doubling the morale of any hero who holds it. It does not differ in any other way from an ordinary weapon. Write a class `MagicWeapon` that extends class `Weapon`, and write a modified version of the method `morale` in class `Hero` that will cause magic weapons to have the desired effect.

b) One being is described as "mightier" than another if it has a higher value in its strength field. However, a hero with a weapon is mightier than another if the strength field plus the power of the weapon is greater. Write a method `mightier` to add to class `Being` to compare `Being`s in this way, and a method which overrides it in class `Hero` to take account of the weapon factor.

Part B

Question 1

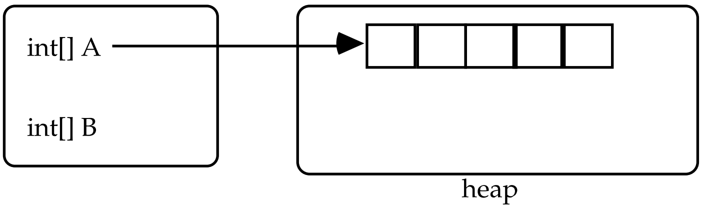
Assume the following picture shows the state of the store before the execution of each sequence of instructions below.



Then, for each of parts (a) to (d) below complete the picture of the state of the store after the execution of the given program.

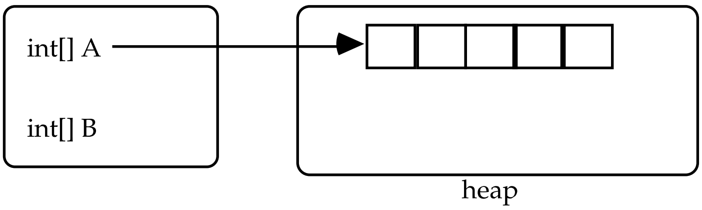
a)

```
for (int i=0; i<4; i++)
   A[i] += A[i+1];
```



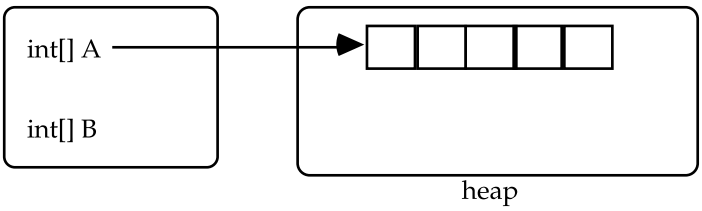
b)

```
for (int i=0; i<3; i++)
   A[i] = A[3-i];
```



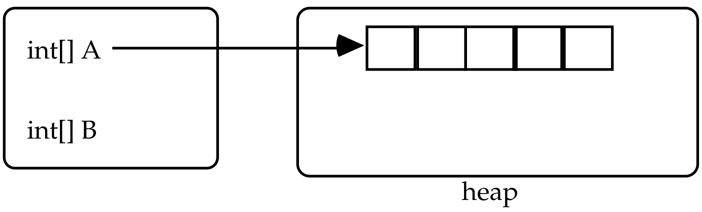
c)

```
B = new int[6];
B[0]=1;
B[5]=20;
for (int i=1; i<5; i++)
   B[i] = A[i]+B[i-1];
```



d)

```
B = new int[4];
for (int i=0; i<4; i++) {
    A[i]--;
    B[i] = A[i]+A[i+1];
}
```



Question 2

a) Write a method which takes an array of integers, and returns the sum of all the integers in the array. For example, if the array was `A` in its initial state in question 1, the result would be 28.

b) Write a method which takes an array of integers and an integer *n*, and returns the position of the first occurrence of *n* in the array. For example, if the array was `A` in its initial state in question 1, and *n* was 7 the result would be 3. The result should be –1 if the integer does not occur in the array.

c) Write a method which takes an array of integers, and returns the array obtained by squaring all the integers in the array. For example, if the array was `A` in its initial state in question 1, the array returned would represent the state

4	9	25	49	121

Question 3

The following program is intended to read a series of two digit integers, ended by 0, and print the mean and median. There are some syntax errors which will cause the program not to compile, and some logic errors which will cause it not to behave correctly when run. The basic algorithm is correct though. Write below what the errors are. Line numbers have been added so you can refer to them.

```
 1  import java.io.*;
 2  class Averages {
 3   public static final int MAX=100;
 4
 5   public static void main(String[] args)
 6   throws IOException
 7   {
 8    int[] numcount = new int[Max];
 9    BufferedReader in = new
10      BufferedReader(new InputStreamReader(System.in));
11    int num,sum=0,ncount=0;
12    for(int count=0;num>0,count++) {
13        num=in.readLine();
14        sum+=num;
15        numcount[num]++;
16    System.out.println("Mean value is: ",sum/count);
17    for(i=0;ncount<count/2;i++);
18       ncount+=numcount[i];
19    System.out.println("Median value is "+i);
20   }
21  }
```

Please use the space here if you need any additional space to answer any of the questions. For anything written here, please indicate which question it applies to.