

Birkbeck
(University of London)
Software and Programming 1
In-class Test 2
26 Mar 2020

Student Name _____
Student Number _____

Answer ALL Questions

1. What output is produced when the following Java program fragment is executed? You should show your workings.

```
int p = 3;  
for (int n = 2; p < 50; n += 3)  
    p += n;  
System.out.println(p);
```

(6 marks)

Answer:

Workings:

2. Let `title` be a variable of type `String`. Write a Java expression (of type `String`) that is evaluated to `title` enclosed in "[" and "]" if `title` is no longer than 10 characters the first 7 characters of `title` enclosed in "[" and "...]" otherwise. For example, if `title` is "hello", then the value of the expression should be "[hello]"; if `title` is "greetings, humans", then the value of the expression should be "[greetin...]".

Assume `title` is not null. Your expression, however, should never throw an `IndexOutOfBoundsException`: recall that method

```
String substring(int beginIndex, int endIndex)
```

of class `String` throws an `IndexOutOfBoundsException` if the `beginIndex` is negative, or `endIndex` is larger than the length of this `String` object, or `beginIndex` is larger than `endIndex`.

An expression *cannot* contain `if` or `return` statements; instead, one should be able to place it as *expr* in the following Java code:

```
public class T { public static void main(String[] args) { System.out.println(expr); } }.
```

Answer:

3. What output is produced when the following Java program fragment is executed
- ```
if (d >= 0) if (d == 1) System.out.print("U"); else System.out.print("Z");
System.out.print("N");
```
- after each of the following declarations:
- (a) `int d = 0;`
  - (b) `int d = 1;`
  - (c) `int d = -1;`

You should show your workings.

(5 marks)

**Answer:**

4. A *run* is a sequence of adjacent repeated values. Implement a method

```
public static void printRuns(String[] v)
```

that prints the array with each run of length greater than 1 marked by including it in parentheses.

For example, on the input array

```
a b e e c a a a b d c b b b b c f e e c a
```

the method should produce the following output:

```
a b (2 e) c (3 a) b d c (4 b) c f (2 e) c a
```

(the 2 es, the 3 as, 4 bs and 2 es all form runs of length greater than 1, and the number after the bracket specifies the length of the run). **(22 marks)**

**Answer:**

5. Implement a method

```
public static double[] product(double[] v1, double[] v2)
```

that, given two arrays,  $v1$  and  $v2$ , of floating-point numbers, returns a *new* array containing the component-wise product of vectors  $v1$  and  $v2$ , that is, an array whose  $i$ th element is  $v1[i] * v2[i]$ .

For example, if  $v1$  is  $\{ 5, 2, 3 \}$  and  $v2$  is  $\{-1, 2, 0\}$ , then the method should return  $\{ -5, 4, 0 \}$ . (10 marks)

**Answer:**

6. What output is produced when the following Java program is executed?

```
public class E20 {
 public static void main(String args[]) {
 int[] a = { 1, 2, 3, 1 };
 System.out.println(a[h(a, 1)] + 1 == a[h(a, 2)] ? "yes" : "no");
 }
 public static int h(int[] v, int i) {
 return v[v[i]];
 }
}
```

You should show your workings.

**(10 marks)**

**Answer:**

**Workings:**

7. Suppose you have declared a class `Question` as follows:

```
public class Question {
 public int getPoints(String answer) { return 0; }
}
```

- (a) Write a subclass `SimpleTextQuestion` of class `Question`. The class should have two instance variables: `correctAnswer` of type `String` and `points` of type `int`. It should have a single constructor taking the two parameters and storing them in the instance variables. Implement instance methods `getPoints(String answer)` (that compares the provided answer with the correct answer and returns points if they match and 0 otherwise) and `getCorrectAnswer()` (that returns the stored correct answer). (7 marks)
- (b) Write a subclass `MultipleChoiceQuestion` of class `Question`. The class should have three instance variables: `options` of type `String[]`, and `correctAnswerIndex` and `points` of type `int`. It should have a single constructor taking the three parameters and storing them in the instance variables. Implement methods `getPoints` and `getCorrectAnswer` (see Item (a) for an explanation of the two methods). (7 marks)
- (c) Override method `toString()` in the two classes, `SimpleTextQuestion` and `MultipleChoiceQuestion`, in such a way that they each return a suitably constructed string representation of the instances. (7 marks)
- (d) Write a class `Questionnaire`, whose instances can contain up to 10 `Questions`. Implement the following instance methods:
- `void addQuestion(Question question)` adds the question to the questionnaire (if the capacity is exceeded, then the method should do nothing);
  - `int getCount()` returns the number of questions in the questionnaire.
- (7 marks)
- (e) Implement the following instance method in class `Questionnaire`:
- `int getPoints(String[] answers)` returns the total number of points for the answers provided (assume that the length of answers coincides with the number of questions in the questionnaire).

(12 marks)

**Answer:**