Enrolment Number:

The University of Melbourne
School of Computing and Information Systems

Semester 2, 2017 Sample Assessment

COMP90041
Programming and Software Development

Reading Time: 15 minutes

Writing Time: 2 hours

This paper has 15 pages.

Total marks for this paper: 60

Authorised Materials:

Writing instruments (e.g., pens, pencils, erasers, rulers).
No other materials and no electronic devices are permitted.

Instructions to Invigilators:

Students will write their answers in the exam paper itself.

The exam paper must remain in the exam room and be returned to the subject coordinator.

Instructions to Students:

Write your enrolment (student) number in the box above. Answer questions directly on this exam paper in the box(es) provided. Use the flip sides of pages for rough work. The last 2 pages are provided in case you need more space for any answers. If you use this overflow space, put a note where the answer belongs saying where the rest of the answer is.

The marks for each question are listed at the beginning of the question. You should attempt all questions. Use the number of marks allocated to a question as a rough indication of the time to spend on it. We have tried to provide ample space for your answers; do not take the amount of space provided for an answer as an indication of how much you need to write.

This paper must *not* be lodged with the university library.

Examiners' use:

1	2	3	4	5	6	7	8	9	**Total**

Use this page for scratch work. **Work written here will not be assessed.**

Question 1 [6 marks]

Consider a method whose definition is the following:

```
static String testmethod(int n)
{
     String r = "none";

     switch (n)
     {

     case 1: r = "one";
     case 2: r = "two";
     case 3: r = "three";

     }

     return r;
}
```

What string is returned by each of the following calls?

(a) `testmethod(1)`

(b) `testmethod(2)`

(c) `testmethod(8)`

Use this page for scratch work. **Work written here will not be assessed.**

Question 2 **[6 marks]**

There are some actions that the implementations of static methods cannot perform that the implementations of non-static methods can perform. Give an example, and give the reason why Java does not allow static methods to perform that action.

Use this page for scratch work. **Work written here will not be assessed.**

Question 3 [6 marks]

As of Java 1.5, Java supports generic types, for example `ArrayList`. What is a generic type? How is this an improvement on the `ArrayList` class of Java 1.4, when Java did not support generics?

Use this page for scratch work. **Work written here will not be assessed.**

Question 4 [3 marks]

What will this code fragment print?

```
int x=3, y=0;
while (x>=0) {
     y++;
     x--;
}
System.out.println(y);
```

Question 5 [3 marks]

What will this code fragment print?

```
int[] a = {1,1,2};
int sum = 0;
for (int i=1; i<=3; ++i) {
     sum += a[i];
}
System.out.println(sum);
```

Use this page for scratch work. **Work written here will not be assessed.**

Question 6 [6 marks]

A *privacy leak* in a Java program occurs when a class's internal data can be manipulated by methods of other classes, despite being declared `private`. List at least two ways this can happen, and give an example. List as many ways as you can think of for the author of the class to prevent privacy leaks.

Use this page for scratch work. **Work written here will not be assessed.**

Question 7 **[6 marks]**

The println method of the System.out object can be used to print any object, regardless of which primitive type or class it belongs to. Outline the mechanism that println uses to accomplish this task.

Use this page for scratch work. **Work written here will not be assessed.**

Question 8 [9 marks]

Write a method that takes an array of `int` as its only input and returns the average of the values in the array as a `double`.

Use this page for scratch work. **Work written here will not be assessed.**

Question 9 [15 marks]

Write two classes, `Position` and `Displacement`. A `Position` represents a Cartesian (x, y) position pair, and a `Displacement` represents a Cartesian distance, that is, a $(\delta x, \delta y)$ pair. Ensure that both classes are **immutable**. In both cases, values should be represented as `double`s.

These classes should implement the following operations:

- Construct new `Position` and `Displacement` objects;
- Subtract one `Position` from another to get a `Displacement`;
- Add a `Displacement` to a `Position` to get a `Position`;
- Add two `Displacement`s to get a `Displacement`;
- Scale (multiply) a `Displacement` by a scalar (`double`);
- Get the `x` and `y` components of both `Position`s and `Displacement`s.

Please write your answer on pages 10–13.

Use this page for scratch work. **Work written here will not be assessed.**

Answer to Question 9

Use this page for scratch work. **Work written here will not be assessed.**

Answer to Question 9 (continued)

Use this page for scratch work. **Work written here will not be assessed.**

Answer to Question 9 (continued)

Use this page for scratch work. **Work written here will not be assessed.**

Answer to Question 9 (continued)

Use this page for scratch work. **Work written here will not be assessed.**

Overflow Answer Page 1

You may use this space to continue any answer, but if you do, indicate *clearly* in your previous answer that you have continued onto this page, or this part of your answer may be overlooked.

Use this page for scratch work. **Work written here will not be assessed.**

Overflow Answer Page 2

You may use this space to continue any answer, but if you do, indicate *clearly* in your previous answer that you have continued onto this page, or this part of your answer may be overlooked.

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