THE UNIVERSITY OF MELBOURNE
DEPARTMENT OF COMPUTING AND INFORMATION SYSTEMS

SAMPLE EXAMINATION – SEMESTER 1, 2016
COMP90041 PROGRAMMING AND SOFTWARE DEVELOPMENT

Reading Time: **15** minutes **Total marks for this Exam: 60**
Writing Time: **2** hours
This exam has 7 pages.

Identical Examination Papers: None
Common Content Papers: None

Authorised Materials:
Writing materials, e.g., pens, pencils, are allowed.
Books, calculators, and dictionaries are not allowed.

Instructions to Invigilators:
Supply students with standard script book(s).

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

Instructions to Students:
- Attempt all questions
- Answer all questions in the provided answer booklet. Put your answer next to the corresponding question number for each question. Answer all the multiple choice questions on the first page of the answer booklet.
- Clearly number and write your answers. Any unreadable answer will be considered wrong.
- For multiple choice questions, choose the best answer.
- Use the marks as a guide to level of details required in your answer while keeping your answer concise and relevant.

This paper may not be held by Baillieu Library

Multiple choice questions [choose only one answer for each question]: [1 mark each]

1. Java is an example of
   a) machine language
   b) assembly language
   c) high-level language
   d) procedure oriented programming language
   e) all of the above

2. If `x` is an `int` and `y` is a `double`, which of the following is an illegal assignment statement?
   a) `y = x;`
   b) `x = y;`
   c) `y = (double) x;`
   d) `x = (int) y;`
   e) all of the above are legal

3. To compare two strings lexicographically, which of the following String methods should be used?
   a) `equals()`
   b) `equalsIgnoreCase()`
   c) `compareTo()`
   d) `==`
   e) all of the above

4. In order to declare a constant, you would use which of the following Java reserved words?
   a) `private`
   b) `static`
   c) `int`
   d) `final`
   e) `class`

5. If two variables contain references of the same object then
   a) The object may be modified using either alias
   b) The object cannot be modified unless there's but a single reference to it
   c) A third reference is created if/when the object is modified
   d) The object will become an "orphan" if both variables are set to null
   e) Answers (a) and (d) are correct

6. Say you write a program that has the following statement in it:
`Random rand;`
But you fail to include an import statement for `java.util.Random` (or `java.util.*`). What will happen when you attempt to compile and run your program.
a) The program will not run, but it will compile with a warning about the missing class.
b) The program will not compile – you'll receive a syntax error about the missing class.
c) The program will compile, but you'll receive a warning about the missing class.
d) The program will encounter a runtime error when it attempts to access any member of the Random class
e) None of the above

7. Consider the following enumeration:
```
enum Speed { FAST, MEDIUM, SLOW };
```
Which of the following statements is evaluated to be `true` ?
a) `Speed.MEDIUM == Speed.values()[2];`
b) `Speed.values()[3] == Speed.SLOW;`
c) `Speed.values()[0] == Speed.FAST;`
d) `Speed.values()[3] == Speed.MEDIUM;`
e) None of the above

8. What will be displayed by the following command:
```
System.out.println(Math.pow(3, 3-1));
```
a) 9.0
b) 8.0
c) 6.0
d) 4.0
e) 27.0

9. The relationship between classes and objects is best described as:
a) classes are instances of objects
b) objects are instances of classes
c) objects and classes are the same thing
d) classes are programs while objects are variables
e) objects are the instance variables of classes

10. A class' constructor usually defines which of the following
   a) how an object is initialized
   b) how an object is interfaced
   c) the number of instance data in the class
   d) the number of methods in the class
   e) if the instance variables are accessible outside of the object directly

11. Consider a method defined with the header: `public void foo(int a, int b).` Which of the following method calls is legal?
   a) `foo(0, 0.1);`
   b) `foo(0 / 1, 2 * 3);`
   c) `foo(0);`
   d) `foo( );`
   e) `foo(1 + 2, 3 * 1.0);`

12. It is easier to correct errors found in a program if
   a) they are identified early in the development cycle
   b) they are identified during testing
   c) they are identified during program use
   d) they are identified during maintenance
   e) all of the above are equally true, errors are easily corrected in any of these stages

13. Given following code fragment:

```
ArrayList<Double> marks = new ArrayList<Double>();
marks.add(3.0);
marks.add(2.5);
marks.add(4.9);
marks.add(2, 3.6);
marks.add(1, 1.5);
double a = marks.get(3);
double b = marks.get(4);
marks.remove(2);
double c = marks.get(2);
boolean d = marks.contains(3.6);
int e = marks.indexOf(4.9);
```

which statement is evaluated to be `true`:
   a) `a == 2.5`
   b) `b < c`
   c) `a == c`
   d) `!d`
   e) `e == 2`

14. Assume this statement: `int[] values = {9,4,12,2,6,8,18};` Now the statement: `System.out.println(values[7]);` will do:

a) output 7
b) output 18
c) output nothing
d) cause an `ArrayOutOfBoundsException` to be thrown
e) cause a syntax error

15. Given the class definition:

```
public class Jump extends Exception {
      private int n;
      public Jump( int k ) { n = k; }
      public getN() { return n; }
}
```

then after executing the following code

```
int k = 0;
try {
      k = 1;
      throw new Jump(k);
      k = 2;
} catch ( Exception e ) {
      k = 3;
}
```

the variable `k` will have the value:

a) 0, because the `try` block will never be executed.
b) 1, because the `Jump` object thrown does not match the catch clause, and therefore the flow of control leaves the `try` block entirely.
c) 1, because the class `Jump` does not contain `Exception` as part of its name, and therefore cannot be used as an exception.
d) 2, because the `Jump` object thrown does not match the `catch` clause, and therefore the `throw` statement has no effect.
e) 3, because `Jump` is a subclass of `Exception`, and therefore the `catch` clause matches.

Short answer questions

Answers for the following questions briefly (in about three sentences).

16. What is the advantage of generics? Give the name of a generic class that we have learned in our lectures. **[2 marks]**

17. Name all the access permission modifiers in Java. Which one is the preferred access permission for instance variables of a class? **[2 marks]**

18. Consider the following Java code:

```
public class Fruit {
     public void f() {
          System.out.println("A fruit");
     }
}

public class Apple extends Fruit {
     public void f() {
          System.out.println("An apple");
     }
}

public class Test {
     public static void main(String[] args) {
          Apple apple = new Apple();
          Fruit fruit = apple;

          fruit.f();
     }
}
```

What is the output when we execute the program `Test`, `"A fruit"` or `"An apple"`? Why does it give this particular output rather than the other one? **[2 marks]**

19. Explain the difference between method overloading and method overriding. Give example of the scenario of using each of these mechanisms. **[4 marks]**

Programming questions

20. **[6 marks]** Consider the following program execution:

```
> java starTriangle
Enter an integer: 5
*
**
***
****
*****
```

This program reads an integer `n`, and then prints a triangle with `n` rows of '*' characters. Write a class named `starTriangle` with a `main()` method to implement the above process. You can declare more variables if necessary.

21. **[5 marks]** Write a code fragment that declares an array of 10 integers called `myArray` and then initialize each element of the array to have the value of `i`^{2} where `i` is the index of the element. For instance, the value for element `myArray[2]` must be set to `4` (i.e. 2^2).

22. [**6 marks**] Write an interface named `XYInterface` that contains two int constants, `X = 5` and `Y = 10` and a method called `useXY()` which receives no parameters and returns an integer value. (You don't need to implement the `XYInterfac`)

23. **[7 marks]** A software system called `VideoSys` allows video rental stores to maintain their members and video library. For each member, the system shall maintain a unique membership number, a name and a contact phone number. For each video, the system shall maintain a unique identification number, a title, the year of release and a rental status (indicating whether the video is currently rented out or not). The system should allow each member to rent up to 5 videos at a time. Each member should be able to list the id number and title of all videos he or she is currently renting.

    Draw a class diagram for `VideoSys` based on the above requirements.

24. [**6 marks**] A prime number is a positive integer which can only be divided by 1 and itself. The list of prime numbers starts with 2, 3, 5, 7, 11, 13, 17, 19, 23, …
    Write a Java class called `PrimeNumber`, which contains a `main()` method that reads a positive integer number from the command line, determines whether the number is prime or not, and outputs the result as following example runs.

```
> java PrimeNumber
Enter a number:
7
7 is a prime number.

> java PrimeNumber
Enter a number:
6
6 is not a prime number.
```

    In the example above, the first line (`"Enter a number:"`) and the last line (`"7 is a prime number."`) are generated by the program. The second line, which contains only a number, is the input entered by the user.

25. [**5 marks**] Define an exception class called `InvalidDateException`. The class should have a constructor with no parameters. If an exception is thrown with this non-argument constructor, `getMessage` should return "Invalid date!" The class should also have a constructor with a single parameter of type String. If an exception is thrown with this constructor, then `getMessage` returns the string that was used as the argument to the constructor.

End of sample exam