

# THE UNIVERSITY OF AUCKLAND

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SECOND SEMESTER, 2016

Campus: City

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COMPUTER SCIENCE

Software Construction

TEST

(Time Allowed: 50 Minutes)

- The use of calculators is NOT permitted.
- Compare the test version number on the Teleform sheet supplied with the version number above. If they do not match, ask the test supervisor for a new sheet.
- Enter your name and student ID on the Teleform sheet. Your name should be entered left aligned. If your name is longer than the number of boxes provided, truncate it.
- Answer ALL **multiple-choice** questions on the Teleform answer sheet provided.
- Use a dark pencil to mark your answers in the multiple choice answer boxes on the Teleform sheet. Check that the question number on the sheet corresponds to the question number in this question/answer book. If you spoil your sheet, ask the supervisor for a replacement.
- This test is marked out of 45 marks and counts for 15% of your final grade.
- Each question is expected to have exactly 1 (one) correct answer. If you believe that a question has either NO or MULTIPLE correct answers, select the ONE you believe is most likely to be the intended answer.
- A detachable appendix is included.

**MULTIPLE CHOICE QUESTIONS**

For each question, choose the best answer according to the information presented in lectures. Select your preferred answer on the Teleform answer sheet by shading in the appropriate box in pencil.

**Question 1**

[1 mark] What output is produced when the following code is executed?

```
System.out.println("(" + 4 + 4 + 3 * 5 / 2 + ", " + 2 + 2 + ")");
```

- (a) [15.5,4]
- (b) [15,22]
- (c) [15.5,22]
- (d) [447,22]**
- (e) [447.5,22]

**Question 2**

[1 mark] What output is produced when the following code is executed?

```
String digits = "14";  
System.out.print(3 + digits);  
System.out.print(1 + Integer.parseInt(digits));
```

- (a) 17114
- (b) 314114
- (c) 31415**
- (d) 329
- (e) 143114

**Question 3**

[1 mark] What output is produced when the following code is executed?

```
String word = "JOYFUL";  
char c = word.charAt(word.length() - 1);  
word = word.substring(0, 1) + word.substring(3) + c;  
System.out.println(word);
```

- (a) JFULU
- (b) JFULF
- (c) JOFULF
- (d) JFULL**
- (e) None of the above

**Question 4**

[1.5 marks] Consider the following code fragment:

```
int[] array = {1,2,3,4,5};
for (int i: array) {
    if (i<=2)
        KEYWORD1;
    System.out.print(i);
    if (i==4)
        KEYWORD2;
}
```

What should *KEYWORD1* and *KEYWORD2* be respectively, in order to produce the output "34"?

- (a) break, break
- (b) continue, break**
- (c) continue, continue
- (d) break, continue
- (e) None of the above

**Question 5**

[1.5 marks] What output is produced when the following code is executed?

```
int a = 30;
int b = 20;
if (a - b == 20) {
    System.out.print("s");
} else if (a != b) {
    if (a < b) {
        System.out.print("e");
    } else if ((a + b) > 0) {
        System.out.print("i");
    }
} else {
    System.out.print("n");
}
System.out.print("o");
```

- (a) eo
- (b) eno
- (c) so
- (d) io**
- (e) None of the above

**Question 6**

[1.5 marks] What output is produced when the following code is executed?

```
String[] words = {"no", "matter", "how", "they", "work"};
for (int i = 0; i < words.length; i++) {
    if (words[i].length() <= 3) {
        System.out.print(words[i].charAt(0));
    }
}
```

- (a) they
- (b) nmhtw
- (c) nh
- (d) h
- (e) Nothing would be printed

**Question 7**

[1.5 marks] What output is produced when the following code is executed?

```
Point[] pts = new Point[2];
pts[0] = new Point(100, 200);
pts[1] = new Point(300, 400);

Point temp = pts[1];
pts[1] = pts[0];
pts[1].x = pts[0].y;
pts[0] = temp;

System.out.println(pts[0] + " " + pts[1]);
```

- (a) java.awt.Point[x=200,y=200] java.awt.Point[x=300,y=400]
- (b) java.awt.Point[x=300,y=400] java.awt.Point[x=100,y=100]
- (c) java.awt.Point[x=200,y=400] java.awt.Point[x=100,y=200]
- (d) java.awt.Point[x=300,y=400] java.awt.Point[x=200,y=200]
- (e) None of the above

**Question 8**

[1.5 marks] Given the code fragment below, which of the following sections of code prints “java.awt.Point[x=1,y=2] java.awt.Point[x=3,y=4] java.awt.Point[x=5,y=6]”?

```
Point[] x = {new Point(1,2), new Point(3,4), new Point(5,6)};
List<Point> points = new ArrayList<Point>(Arrays.asList(x));
```

- (a) for (int i=0;i<points.size();i++) System.out.print(points.get(i)+" ");
- (b) for (int i=0;i<points.size();i++) System.out.print(points[i]+" ");
- (c) for (int i=0;i<x.length();i++) System.out.print(x[i]+" ");
- (d) for (int i=0;i<x.length;i++) System.out.print(x.get(i)+" ");
- (e) None of the above

**Question 9**

[1.5 marks] Consider the following variable declarations:

```
Point p1, p2;
Rectangle r1, r2;
p1 = new Point(10, 20);
p2 = new Point(30, 40);
r1 = new Rectangle(10, 20, 30, 40);
r2 = new Rectangle(50, 60, 70, 80);
```

Given these variable declarations, only **ONE** of the following statements will COMPILE. Which one?

- (a) `boolean result = p1.contains(r1);`
- (b) `boolean result = p2.contains(p2);`
- (c) `boolean result = p1.intersects(p2);`
- (d) `boolean result = r1.intersects(p2);`
- (e) `boolean result = r2.contains(p1);`

**Question 10**

[1.5 marks] The "extensions.txt" file contains the phone extensions for all university staff. Each line of the file contains a **SINGLE** integer value, representing a phone extension. There are no other numbers or text stored on each line. Here is the start of the file

```
83014
83020
83035
```

Which of the following code fragments will read all the extensions into an `ArrayList` called `numbers`?

- (a) 

```
BufferedReader br = new BufferedReader(new
    FileReader("extensions.txt"));
while (br.hasNextLine())
    numbers.add(Integer.parseInt(br.readLine()));
```
- (b) 

```
BufferedReader br = new BufferedReader(new
    FileReader("extensions.txt"));
while (br.readLine() != null)
    numbers.add(Integer.parseInt(br.readLine()));
```
- (c) 

```
Scanner in = new Scanner(new File("extensions.txt"));
while (in.hasNextInt())
    numbers.add(in.nextInt());
```
- (d) 

```
Scanner in = new Scanner(new File("extensions.txt"));
while (in.readLine() != null)
    numbers.add(in.nextInt());
```
- (e) None of the above

**Question 11**

[1.5 marks] The "data.txt" file contains some integers. Each line of the file contains zero or multiple integers. Here is the start of the file:

```
22    2
3     33
```

1

What is the output of the following code fragment?

```
Scanner in = new Scanner(new File("data.txt"));
while (in.hasNextInt())
    numbers.add(in.nextInt());
System.out.println(numbers);
```

- (a) [22, 3, 1, 2, 33, 0]
- (b) [22, 3, 1, 2, 33]
- (c) [22, 2, 3, 33, 0, 1]
- (d) [22, 2, 3, 33, 1]**
- (e) None of the above

The class below is used by the following 3 questions:

```
class Hat {
    private int ID = 0;
    private String name = "hat";
    public Hat() { }
    public Hat(int x, String n) { ID = x; name = n; }
    public int getID() { return ID; }
    public String getName() { return name; }
    public void setName(String name) { this.name = name; }
    public String toString() { return ID + " " + name; }
    public Hat operate(Hat other) {
        return new Hat(ID + other.getID(), name + other.getName());
    }
}
```

**Question 12**

[1 mark] Given the following code fragment:

```
public class TestHat {
    public static void main(String[] args) {
        Hat blackCowboyHat = new Hat();
        // COMPLETE THIS
        ...
    }
}
```

Which statement sets the name of the Hat instance created above?

- (a) blackCowboyHat.setName = "Cowboy Hat";
- (b) blackCowboyHat.setName("Cowboy Hat");**
- (c) blackCowboyHat.name = "Cowboy Hat";
- (d) Hat.setName("Cowboy Hat");
- (e) None of the above

**Question 13**

[1.5 marks] What output is produced when the following code is executed?

```
Hat blackCowboyHat = new Hat(1, "Cowboy");
Hat fancyHat;
fancyHat = blackCowboyHat;
blackCowboyHat = new Hat(2, "Gentleman");
System.out.print(fancyHat.getName());
System.out.print(" ");
System.out.print(blackCowboyHat.getName());
```

- (a) A NullPointerException would occur
- (b) Gentleman Gentleman
- (c) Cowboy Cowboy
- (d) Cowboy Gentleman
- (e) None of the above

**Question 14**

[1.5 marks] What output is produced when the following code is executed?

```
Hat blackCowboyHat = new Hat(1, "Cowboy");
Hat gentlemanHat = new Hat(2, "Gentleman");
Hat unknown2 = gentlemanHat.operate(blackCowboyHat);
System.out.print(gentlemanHat);
System.out.print(" ");
System.out.print(unknown2);
```

- (a) 2 Gentleman 3 GentlemanCowboy
- (b) 2 Gentleman 2 Gentleman
- (c) 2 Gentleman 3 CowboyGentleman
- (d) 3 GentlemanCowboy 3 GentlemanCowboy
- (e) None of the above

**Question 15**

[1 mark] To make a variable defined in a class accessible only to methods defined in the classes in same package, which of the following keywords should be used?

- (a) By using the keyword `protected` before the variable.
- (b) By using the keyword `private` before the variable.
- (c) By using the keyword `package` before the variable.
- (d) The variable should not be preceded by any of the above mentioned keywords.
- (e) None of the above

Questions 16 - 19 refer to the method definition listed below. Please take a careful look at this method definition before attempting the questions that follow.

```
public void test_exception(String xValue, String yValue) {
    String result = "";
    int x,y,z;
    try {
        x = Integer.parseInt(xValue);
        y = Integer.parseInt(yValue);
        if (x > 0) {
            z = (x + y) / (x - y);
            result += "a";
        } else if (x < 0) {
            z = x - y;
            result += "b";
        }
    } catch (ArithmeticException e) {
        result += "c";
    } catch (NumberFormatException e) {
        result += "d";
    } catch (ArrayIndexOutOfBoundsException e) {
        result += "e";
    } finally {
        result += "f";
        System.out.println("Result=" + result);
    }
}
```

### Question 16

[1 mark] What output would be produced by the following method call?

```
test_exception("-2", "-2");
```

- (a) Result = bef
- (b) Result = b
- (c) Result = ef
- (d) Result = be
- (e) Result = bf

### Question 17

[1 mark] What output would be produced by the following method call?

```
test_exception("0", "2");
```

- (a) Result = cef
- (b) Result = def
- (c) Result = e
- (d) Result = f
- (e) Result = ef



**Question 18**

[1 mark] What output would be produced by the following method call?

```
test_exception("2", "-");
```

- (a) Result = df
- (b) Result = def
- (c) Result = adf
- (d) Result = de
- (e) Result = ade

**Question 19**

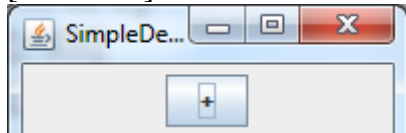
[1 mark] What output would be produced by the following method call?

```
test_exception("2", "-2");
```

- (a) Result = cef
- (b) Result = cf
- (c) Result = af
- (d) Result = aef
- (e) Result = ae

**Question 20**

[1.5 marks] Consider a window that is 200 pixels wide and 100 pixels high, as shown below:



What will be displayed in the button when the button is clicked TWICE according to the code fragment given below?

```
public class SimpleDemo extends JPanel implements ActionListener {
    private JButton aButton;
    public SimpleDemo() {
        aButton = new JButton("+");
        add(aButton);
        aButton.addActionListener(this);
    }

    public void actionPerformed(ActionEvent e) {
        aButton.setText(aButton.getText() + aButton.getText());
        ...
    }
}
```

- (a) +
- (b) +++
- (c) ++
- (d) ++++
- (e) None of the above

**Question 21**

[1.5 marks] Consider the following classes:

```
class A1 {
    int x = 100;
    public int getX() { return x; }
}
class B1 extends A1 {
    int x = 10;
}
class C1 extends B1 {
    int x = 1;
    public int getX() { return x; }
    public String toString() { return //COMPLETE THIS }
}
```

Given the code fragment below, the `toString()` method in the `C1` class is incomplete. Which of the following code fragments should we use in the `toString()` method in order to print “**1 10 100**” ?

```
C1 a = new C1();
System.out.println(a);
```

- (a) `return this.x + " " + super.x + " " + super.super.x;`
- (b) `return this.x + " " + super.x + " " + super.getX();`
- (c) `return this.x + " " + x + " " + super.x;`
- (d) `return this.x + " " + getX() + " " + super.getX();`
- (e) None of the above

The classes below are used by the following 3 questions.

```
class C {
    protected int x = 10;
    protected static int count = 0;
    public C() { x = count++; }
    public int getX() { return x; }
}

class D extends C {
    private int y = x + 10;
    public int getX() { return x * y; }
    public int getY() { return y; }
}
```

Now consider the following code using the above class declarations:

```
C a1 = new C();
C a2 = new D();
D a3 = new D();
```

**Question 22**

[1 mark] What output is produced when the following code is executed?

```
System.out.print(C.count);
```

- (a) 0
- (b) 3**
- (c) 1
- (d) 2
- (e) None of the above

**Question 23**

[1.5 marks] What output is produced when the following code is executed?

```
System.out.print(a1.getX() + " " + a2.getX() );
```

- (a) 0 1
- (b) 0 2
- (c) 0 22
- (d) 0 11**
- (e) None of the above

**Question 24**

[1.5 marks] What output is produced when the following code is executed?

```
System.out.print(((D)a2).getY() + " " + ((D)a3).getY() );
```

- (a) 10 10
- (b) 1 2
- (c) 11 12**
- (d) 11 11
- (e) None of the above

The classes below are used by the following 7 questions.

```
class Pill {
    public void method2() { System.out.print("Pill 2 "); }
}
class Box extends Pill {
    public void method2() { System.out.print("Box 2 "); }
    public void method3() {
        method2();
        System.out.print("Box 3 ");
    }
}
class Cup extends Box {
    public void method1() { System.out.print("Cup 1 "); }
    public void method2() {
        System.out.print("Cup 2 ");
        super.method2();
    }
}
class Jar extends Box {
    public void method1() { System.out.print("Jar 1 "); }
    public void method2() { System.out.print("Jar 2 "); }
}
```

Now consider the following code using these class declarations:

```
Box var1 = new Box();
Pill var2 = new Jar();
Box var3 = new Cup();
Box var4 = new Jar();
Cup var5 = new Cup();
```

### Question 25

[1 mark] Which of the following code fragments would **NOT** cause any compile-time error?

- (a) var1.method1();
- (b) var2.method1();
- (c) var3.method1();
- (d) var4.method1();
- (e) var5.method1();

### Question 26

[1 mark] What is the result of attempting to compile and run the following code fragment?

```
var2.method2();
```

- (a) Pill 2
- (b) Jar 2
- (c) Cup 2
- (d) Box 2
- (e) None of the above

**Question 27**

[1.5 marks] What is the result of attempting to compile and run the following code fragment?

```
var3.method2();
```

- (a) Cup 2
- (b) Box 2
- (c) Cup 2 Box 2 Pill 2
- (d) Cup 2 Box 2
- (e) None of the above

**Question 28**

[1.5 marks] What is the result of attempting to compile and run the following code fragment?

```
var3.method3();
```

- (a) Cup 2 Box 2 Box 3
- (b) Box 3 Cup 3
- (c) Box 3 Box 2 Cup 2
- (d) Box 3
- (e) None of the above

**Question 29**

[1.5 marks] What is the result of attempting to compile and run the following code fragment?

```
var4.method3();
```

- (a) Jar 2
- (b) Run-time error
- (c) Compile-time error
- (d) Jar 2 Box 3
- (e) None of the above

**Question 30**

[1.5 marks] What is the result of attempting to compile and run the following code fragment?

```
((Jar) var3).method1();
```

- (a) Cup 1
- (b) Run-time error
- (c) Compile-time error
- (d) Jar 1
- (e) None of the above

**Question 31**

[1.5 marks] What is the result of attempting to compile and run the following code fragment?

```
((Cup) var3).method2();
```

- (a) Box 2
- (b) Compile-time error
- (c) Run-time error
- (d) Cup 2 Box 2**
- (e) None of the above

**Question 32**

[1.5 marks] Given the following code fragment:

```
public interface Runnable {
    void run();
}
```

Which of the following implements the interface correctly?

- (a) class A implements Runnable { public void run(){ } }**
- (b) class Runnable(public void run() { })
- (c) class A extends Runnable { public void run(){ } }
- (d) class A implements Runnable { public void runner(){ } }
- (e) None of the above

Consider the following interface declaration:

```
public interface Squeezable {
    public void squeeze(int strength);
    public void release();
}
```

Now consider the class Sponge below:

```
class Sponge implements Squeezable {
    public int currentSize;
    static final int FULL_SIZE = 100;
    static final int SQUEEZED_SIZE = 20;

    public Sponge() {
        currentSize = FULL_SIZE;
    }
    public void squeeze(int strength) {
        currentSize = SQUEEZED_SIZE * (2 - strength);
    }
    public void release(boolean quickly) {
        ...
    }
    public void release() {
        ...
    }
}
```

**Question 33**

[1.5 marks] What is the result of attempting to compile and run the above class declaration?

- (a) Compile-time error as the compiler couldn't find a suitable overridden `release()` method.
- (b) Run time error
- (c) Compile-time error as there are two `release()` methods in the `Sponge` class.
- (d) No error**
- (e) None of the above

**Question 34**

[1.5 marks] Which statement about abstract classes and interfaces is **FALSE**?

- (a) All of the methods in both an abstract class and an interface are public.**
- (b) It is not possible to construct either an abstract class object or an interface object.
- (c) An interface cannot implement any methods, whereas an abstract class can.
- (d) An unlimited number of unrelated classes can implement the same interface.
- (e) A class can implement many interfaces but can have only one superclass.

## Appendix

```
class Rectangle
public Rectangle(int x, int y, int width, int height)
boolean contains(int x, int y)
boolean contains(int X, int Y, int W, int H)
boolean contains(Point p)
boolean contains(Rectangle r)
boolean intersects(Rectangle r)
```

```
class Point
Point(int x, int y)
void move(int x, int y)
void translate(int dx, int dy)
```

```
class JButton
void addActionListener(ActionListener l)
void setText(String t)
String getText()
```

```
class Integer
static int parseInt(String s)
```

```
class String
int compareTo(String anotherString)
char charAt(int index)
int indexOf(String str)
int length()
String substring(int beginIndex, int endIndex)
```

```
class ArrayList<E>
boolean add(E e)
void add(int index, E element)
E remove(int index)
boolean remove(Object o)
int size()
<T> T[] toArray(T[] a)
E get(int index)
E set(int index, E element)
```

```
class Arrays
static <T> List<T> asList(T... a)
static void sort(Object[] a)
```

```
class Scanner
boolean hasNext()
boolean hasNextInt()
boolean hasNextLine()
String next()
int nextInt()
String nextLine()
```

```
class BufferedReader
String readLine()
int read()
```