

**THE UNIVERSITY OF WESTERN ONTARIO
LONDON CANADA**

**COMPUTER SCIENCE 026a
MIDTERM EXAMINATION
OCTOBER 28, 2006
2 HOURS**

NAME: _____

STUDENT NUMBER: _____

Question

1-15. _____

16-35. _____

36. _____

37. _____

38. _____

39. _____

40. _____

41. _____

42. _____

TOTAL _____

(Out of 100 marks)

There are no cheat sheets, books, or other reference materials allowed for this exam. No calculators, cell phones, or other electronic devices are permitted either.

Part I – True/False – Determine whether the given statement is true or false. Circle your answer on this examination paper. [15 marks total, 1 mark each]

1. When writing a computer program, everything must be precise and unambiguous.
 - a. True.
 - b. False.

2. English would make a good programming language.
 - a. True.
 - b. False.

3. Java has both primitive data types and reference data types.
 - a. True.
 - b. False.

4. Java lets us declare variables and assign initial values to them at the same time.
 - a. True.
 - b. False.

5. To declare a named constant in Java, we declare a variable and assign an initial value to it, and then precede the declaration with the keyword `final`.
 - a. True.
 - b. False.

6. Java is a case sensitive programming language.
 - a. True.
 - b. False.

7. If two reference variables refer to the same object, we say that there is identity equality between those variables.
 - a. True.
 - b. False.

8. Wherever there is identity equality between two object references, there must also be state equality.
 - a. True.
 - b. False.

9. All `String` methods that modify a string do not change the original string, but instead return a new string with that action done on it.
 - a. True.
 - b. False.

10. In Java, the keyword `this` is used within a method to refer to the object on which the method was invoked.
 - a. True.
 - b. False.

11. JPEG is a lossy compression technique for digital pictures.
 - a. True.
 - b. False.

12. The starting index position for an array in Java is 0.
 - a. True.
 - b. False.

13. The Java `while` loop is a pre-tested loop.
 - a. True.
 - b. False.

14. Digital pictures are composed of many discrete pixels.
 - a. True.
 - b. False.

15. An array is an object in Java.
 - a. True.
 - b. False.

Part II – Multiple Choice – Choose the best answer from the choices given. Circle your answer on this examination paper. [20 marks total, 1 mark each]

16. Which of the following are machine independent programming languages?
 - a. Machine languages.
 - b. Assembly languages.
 - c. High-level languages.
 - d. All of the above.
 - e. None of the above.

17. Which of the following can be concerns in selecting a programming language in which a program is to be written?
 - a. How long does it take to write the program?
 - b. How hard is it to change the program?
 - c. How long does it take to execute?
 - d. All of the above.
 - e. None of the above.

18. Java is a programming language that:
 - a. Was developed in the early 1990s by Microsoft Corporation.
 - b. Works only on Windows and Apple computers.
 - c. Is an object-oriented programming language.
 - d. All of the above.
 - e. None of the above.

19. When a program written in Java is compiled, it is typically compiled to:
 - a. High-level language code.
 - b. Assembly language code.
 - c. Machine language code.
 - d. Bytecode.
 - e. None of the above.

20. In Java, objects:
 - a. Have properties or characteristics that define their state.
 - b. Have behaviours or actions that allow them to do things, or have things done to them.
 - c. Belong to specific classes.
 - d. All of the above.
 - e. None of the above.

21. In Java, the calculation $3 \% 4$ produces a result of:

- a. 0
- b. 1
- c. 0.75
- d. 3
- e. None of the above.

22. Which of the following represents a character in Java:

- a. a
- b. 'a'
- c. "a"
- d. All of the above.
- e. None of the above.

23. Consider the following code segment:

```
int someInteger;  
double someDouble, anotherDouble;  
Picture somePicture, anotherPicture;
```

How many variables were declared in this code segment?

- a. 0
- b. 1
- c. 3
- d. 5
- e. None of the above.

24. Consider the code segment used in the question above. How many objects were created in this code segment?

- a. 0
- b. 1
- c. 3
- d. 5
- e. None of the above.

25. Which of the following is a valid way to create a `String` object containing the text "Hello there" in Java:

- a. `String tempString = "Hello there";`
- b. `String tempString = "Hello" + " " + "there";`
- c. `String tempString = new String("Hello there");`
- d. All of the above.
- e. None of the above.

26. Which of the following is true, according to Java naming conventions discussed in class:
- Class names begin with an uppercase letter.
 - Named constants are in all uppercase letters, with underscores separating words in the name.
 - Variables start with lowercase letters, with each the first letter of each additional word in uppercase.
 - All of the above.
 - None of the above.
27. Methods in Java:
- Are named collections of statements that have a specific purpose
 - May take input and may produce an output
 - Must be defined within classes
 - All of the above.
 - None of the above.
28. In Java, class methods are also known as:
- Static methods.
 - Object methods.
 - Instance methods.
 - All of the above.
 - None of the above.
29. Which of the following Java statements contains the invocation of an object method?
- `int minNumber = Math.min(3,4);`
 - `String lowerName = name.toLowerCase();`
 - `boolean result = Character.isLetter('A');`
 - All of the above.
 - None of the above.
30. Which of the following would create a new `Picture` object in Java?
- `Picture pic;`
 - `Picture pic = oldpic;`
 - `new Picture = FileChooser.pickAFile();`
 - `Picture pic = new Picture();`
 - None of the above.
31. Which of the following Java statements declare and create an array of 20 integers referenced by a variable `marks`?
- `marks = new int[20];`
 - `marks = new int[19];`
 - `new marks[20];`
 - `int [] marks = new int[20];`
 - `int [] marks = new int[19];`

32. Which of the following is the index of the last element of the array marks?
- a. `marks.length;`
 - b. `marks.length();`
 - c. `marks.length()-1;`
 - d. `marks.length-1;`
 - e. `marks.size;`

33. Study the following Java code fragment and then answer the next 3 questions; assume that the variable `picture` has been defined and contains a digital image.

```
Pixel [] allPixels = picture.getPixels();
Pixel aPixel = allPixels[0];
int count = 1;
while (count < allPixels.length) {
    Color aColor = aPixel.getColor();
    aPixel = allPixels[count];
    allPixels[count].setColor(aColor);
    count++;
}
```

The variable `allPixels` is:

- a. A `Picture`.
 - b. A two dimensional array.
 - c. A list of pixels.
 - d. A list of `Colors`.
 - e. A one dimensional array.
34. Which of the following statements most correctly describes what the code in the previous question does?
- a. It makes all the pixels in the picture the same color.
 - b. It makes all the pixels grey.
 - c. It makes a pixel the same color as the one following it in the array.
 - d. It leaves each pixel with its original color.
 - e. None of the above.
35. The body of the `while` loop of the code given in question 33 is executed:
- a. `allPixels.length-2` times.
 - b. `allPixels.length-1` times.
 - c. `allPixels.length` times.
 - d. `allPixels.length+1` times.
 - e. `allPixels.length+2` times.

Part III – Short/Long Answer – Complete the following questions in the space provided on this examination paper.

36. For each of the following Java expressions, both provide the result of evaluating the expression, and identify the type of this value. If the expression is invalid in Java, simply indicate that it is invalid. [10 marks]

a. `"Java" + "is" + "great"`

b. `"123 + 456"`

c. `3 / 2 * 1.0`

d. `"The answer is: " + 5 + 5`

e. `"The answer is: " + (5 + 5)`

f. `Math.min(3,4) < Math.max(2,3)`

g. `'b' > 'a'`

h. `1 + 2 * 3 - 4 / 5`

i. `((int) 1.0) % 5 + 0.5 * 2) / 2.0 - ((double) 1)`

j. `3 / 6 * (16.3 * 20.2 + 960 / 6.0)`

37. Consider the following Java code segment:

```
int numPeople = 4;
System.out.println(numPeople);
double bill = 100.00;
System.out.println(bill);
double tip = bill * 0.2;
System.out.println(tip);
double total = bill + tip;
System.out.println(total);
double totalPerPerson = total / numPeople;
System.out.println(totalPerPerson);
```

Trace this code segment and report what this code prints to the screen. [10 marks]

38. Using a single line of Java code, create an array `intvals` of 5 integers and initialize the array to 0, 1, 2, 3, 4. [5 marks]

39. Recall the turtles world examples from class, labs, and the first assignment. Provide a sequence of Java statements that will create a new world and a new turtle within that world, and will then instruct the turtle to create a rectangle 50 units high and 100 units wide from its starting position. (You only need to provide the statements required to do this in the interactions pane of DrJava, and do not need to contain these statements within methods or a program.) The turtle should both start and end at the bottom left hand corner of this rectangle and be facing the same direction as it started when it has finished its drawing. [10 marks]

40. The following Java method added to the `Picture` class is supposed to reduce the red in a picture by 25%. It has 4 logic errors. (The code compiles fine, but does not behave as expected when it is run.) Correct each error; there is at most 1 error in a line. In the space provided below, rewrite each line with an error and then write how the line should be corrected. [8 marks]

```
public void decreaseRed() {
    Pixel[] pixelArray = this.getPixels();
    Pixel pixelObj = null;
    int index = 1;
    int value = 1;

    // loop through all the pixels
    while(index < pixelArray.length-1) {
        // get the current pixel
        pixelObj = pixelArray[index];

        // get the red value
        value = pixelObj.getRed();

        // decrease the red value
        value = value * 0.25;

        // set the pixel red
        pixelObj.setRed(index);

        // increment the index
        index++;
    }
}
```

Error 1:

Error 2:

Error 3:

Error 4:

41. The following Java code segment makes use of a `while` to compute the sum of the squares of the odd numbers between 2 and 100. In the space provided, you should change it to do the same thing but using a `for` loop instead. [10 marks]

```
int sum = 0;
int i = 3;
while (i < 100) {
    sum = sum + (i*i);
    i++;
    i++;
}
```

42. The following Java methods can be used to create a new `Picture` that is a grey scale version of another `Picture`. The `Picture` is passed as a parameter to the method `makeGrey`. The method `changePixelToGrey` is used to change the color of a pixel to grey. The method `makeGrey` currently uses two `for` loops in a nested fashion. Change just the method `makeGrey` to use a single loop instead. [12 marks]

```
public static Color changeToGrey(Pixel pix) {
    int red = pix.getRed();
    int green = pix.getGreen();
    int blue = pix.getBlue();
    int value = (red + green + blue) / 3;
    return Color(value,value,value);
}

public static Picture makeGrey(Picture pic) {
    Picture newPic = Picture(pic);
    for (int x = 0; x < newPic.getWidth(); x++) {
        for (int y = 0; y < newPic.getHeight(); y++) {
            Pixel pixel = newPic.getPixel(x,y);
            pixel.setColor(changeToGrey(pixel));
        }
    }
    return newPic;
}
```

This page has been left intentionally blank. Use it as additional workspace or extra space for answers if necessary.