

Part I. Multiple Choice Questions (2 points each):

1. Which of the following is NOT a key component of object oriented programming?
 - (a) Inheritance
 - (b) Encapsulation
 - (c) Polymorphism
 - (d) Parallelism *****
2. Which of these is TRUE of the relationship between objects and classes?
 - (a) A class is an instance of an object.
 - (b) An object is the ancestor of its subclass.
 - (c) An object is an instance of a class. *****
 - (d) An object is the descendant of its superclass.
3. The Java compiler translates source code into
 - (a) machine code.
 - (b) Assembly code.
 - (c) Byte code. *****
 - (d) JVM code.
4. Which of the following is NOT a valid 'type' in Java?
 - (a) void
 - (b) int
 - (c) Integer
 - (d) static *****
5. Which of the following statements is NOT correct?
 - (a) We can use a new operator on String to create a "String" object.
 - (b) We can use the new operator on int to create an "int" object. *****
 - (c) Variables of type "int" can be assigned a value just after being declared.
 - (d) Variables of type "String" can be assigned a value just after being declared.
6. Which of the following statements can provide the output "180"?
 - (a) `String str = "CS180";
System.out.print(str.substring(2, 4));`
 - (b) `String str = "CS180";
System.out.print(str.substring(3, 5));`
 - (c) `String str = "P";
System.out.print(str.length() + "80");` *****
 - (d) `String str = "P";
System.out.print(str.length() + 80);`

7. What is the output of the following code if the input string is "CS 180"?

```
Scanner scanner = new Scanner();
String str;
str = scanner.next();
System.out.print(str);
```

- (a) CS180
- (b) CS
- (c) CS 180
- (d) The above code fragment does not compile. *****

8. Which of the following is NOT true?

- (a) Both float and double represent real numbers.
- (b) long can present a larger range of values than double. *****
- (c) The size of long and double is the same.
- (d) char is not a numeric data type.

9. Which of the following is TRUE about the piece of JAVA code below if we judge the statements independently?

```
final double PI;
int radius = Integer.parseInt("3.5");
double area = Math.PI * Math.pow(radius, 2);
```

- (a) The third statement computes the area of a circle whose radius is in variable radius. *****
- (b) The first statement correctly declares the constant PI.
- (c) The second statement correctly obtains the radius from the given string.
- (d) The third statement incorrectly uses Math.pow.

10. What is the value of y when the code below is executed?

```
int x = 4;
int y = (int)Math.ceil(x % 5 + x / 5.0);
```

- (a) 1
- (b) 6
- (c) 5 *****
- (d) 4

11. Which of the following statements is TRUE?

- (a) The Java compiler always adds a default constructor to a user defined class.
- (b) Each instantiated object will have its own copy of a class variable.
- (c) When an object is passed to a method, a copy of each of the object's data members are created and passed to the method.
- (d) A class can have multiple constructors. *****

12. What is the range of the random number `r` generated by the code below?

```
int r = (int)(Math.floor(Math.random() * 8)) + 2;
```

- (a) `3 <= r <= 10`
- (b) `3 <= r <= 9`
- (c) `2 <= r <= 10`
- (d) `2 <= r <= 9` *****

13. If a local variable of a method `shop()` belonging to a class called `Walmart` has the same name as a data member of `Walmart`, which value is used when `shop()` is executing?

- (a) the local variable's *****
- (b) the class variable's
- (c) the data member's
- (d) None of the above since this would cause a compiler error.

14. What will be printed by the code fragment below?

```
double height = 5.5;

if(height-- >= 5.0)
    System.out.print("tall ");
if(--height >= 4.0)
    System.out.print("average ");
if(height-- >= 3.0)
    System.out.print("short ");
else
    System.out.print("very short ");
```

- (a) short
- (b) average short
- (c) tall short *****
- (d) tall

15. Translate this statement into Java:

If the value of temperature is in between 20.0 and 40.0, print "very cold".

- (a) `if(!(temperature < 20.0 || temperature > 40.0)) *****`
 `System.out.println("very cold");`
- (b) `if(20.0 <= temperature <= 40.0)`
 `System.out.println("very cold");`
- (c) `if(temperature >= 20.0 || temperature <= 40.0)`
 `System.out.println("very cold");`
- (d) `if(temperature >= 20.0 | temperature <= 40.0)`
 `System.out.println("very cold");`

16. What is the value of 'n' after executing the following code?

```
int n = 20;

switch(n)
{
    case 10: n = n + 1;
    case 15: n = n + 2;
    case 20: n = n + 3;
    case 25: n = n + 4;
    case 30: n = n + 5;
}
```

- (a) This code does not compile.
- (b) 25
- (c) 32 *****
- (d) 23

17. What is the value of 'n' after executing the following code?

```
int n = 20;
int p = n + 5;
int q = p - 10;
int r = 2 * (p - q);

switch(n)
{
    case p: n = n + 1;
    case q: n = n + 2;
    case r: n = n + 3;
    default: n = n + 4;
}
```

- (a) 24
- (b) This code does not compile. *****
- (c) 20
- (d) 27

18. What is the value of variable z after executing the following code?

```
int x = 5;
int y = 5;
int z = 5;

if (x > 3)
    if (y > 4)
        if (z > 5)
            z += 1;
        else
            z += 2;
    else
        z += 3;
        z += 4;
```

- (a) 9
- (b) 5
- (c) 11 *****
- (d) 7

19. What is the output of the following program?

```
public class Test
{
    public static void main( String[] args )
    {
        private static final int value = 5;
        float total;
        total = value + value / 2;
        System.out.println( total );
    }
}
```

- (a) 7.5
- (b) 7.0
- (c) 5.0
- (d) None of the above *****

20. Which of the following variables contains null?

```
String a;
String b = new String();
String c = "";
String d = "null";
```

- (a) a *****
- (b) b
- (c) c
- (d) d (this answer also accepted)

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Part II. Programming Questions (60 points total):

1. (20 points) Write a program that prompt for and reads a power of 10 (e.g. 6, 9, 10, ...). It should then displays how big the number is in English (e.g. in Million, Billion, etc.). Display an appropriate message for the input value that has no corresponding word. Here are some output examples:

```
10 raised to the 6th power is a million.  
10 raised to the 12th power is a trillion.  
There is no single word for 10 raised to the 10th power.
```

The table below shows the correspondence between the power of 10 and the word representing the number. Any input value that is outside of the table should be handled as one that has no corresponding word.

Power of 10	Number
6	Million
9	Billion
12	Trillion
15	Quadrillion
18	Quintillion
21	Sextillion
30	Nonillion
100	Googol

You do not need to worry about special ordinal numbers such as 1st, 2nd, 3rd, and so on. That is, you can use "th" for all ordinal numbers. For example:

```
10 raised to the 21th power is a sextillion.  
There is no single word for 10 raised to the 2th power.
```

Note: You MUST USE the switch statement. Write your code on the next page.

Solution for programming question 1:

```
import java.util.Scanner;

public class readPower
{
    public static void main(String[] args)
    {
        Scanner s = new Scanner(System.in);
        System.out.print("Input a positive integer: ");
        int power = s.nextInt();
        boolean valid = true;
        String word = "";

        switch (power)
        {
            case 6: word = "million";
                    break;
            case 9: word = "billion";
                    break;
            case 12: word = "trillion";
                    break;
            case 15: word = "quadrillion";
                    break;
            case 18: word = "quintillion";
                    break;
            case 21: word = "sextillion";
                    break;
            case 30: word = "nonillion";
                    break;
            case 100: word = "googol";
                    break;
            default: valid = false;
        }
        if (valid)
            System.out.println("10 raised to the " + power +
                               "th power is a " + word + ".");
        else
            System.out.println("There is no single word for 10 raised to the " +
                               power + "th power.");
    }
}
```


2. (20 points) Define a class called `Triangle` with three integer data members `a`, `b`, and `c` as the lengths of its three edges. This class should have the following methods:

- (a) a constructor with 3 parameters representing the 3 edges
- (b) a method `isTriangle()` which returns true if the 3 edges are all positive and they satisfy the triangle inequality where $a+b > c$, $a+c > b$, $b+c > a$.
- (c) a method `getAngle()` with 1 parameter, an edge, which returns the angle in degrees of the angle facing the given edge.

The signature of these methods are given below:

```
public Triangle(int newa, int newb, int newc)
public boolean isTriangle()
public double getAngle(int edge)
```

Note: `getAngle()` should return zero if the triangle is not really a triangle. Also, here are a few formulas to help you define the class:

FYI, if A is the angle facing side a , then the following formula should help:

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

Note: Write your code on the next page. It must be a complete class.

Solution for programming question 2:

```
public class Triangle
{
    private int s1;
    private int s2;
    private int s3;

    public Triangle(int a, int b, int c)
    {
        s1 = a;
        s2 = b;
        s3 = c;
    }

    public boolean isTriangle()
    {
        return (s1 > 0 && s2 > 0 && s3 > 0 &&
                ((s1+s2)>s3) && ((s2+s3)>s1) && ((s1+s3)>s2));
    }

    // compute angle facing the given side
    public double getAngle(int side)
    {
        double angle;

        if (!isTriangle())
            return 0;

        if (side == s1)
            angle = Math.acos((s2*s2 + s3*s3 - s1*s1)/(2.0 * s2 * s3));
        else if (side == s2)
            angle = Math.acos((s1*s1 + s3*s3 - s2*s2)/(2.0 * s1 * s3));
        else if (side == s3)
            angle = Math.acos((s2*s2 + s1*s1 - s3*s3)/(2.0 * s2 * s1));
        else
            angle = 0;

        angle = angle * 180.0 / Math.PI;
        return angle;
    }
}
```

3. (20 points) For this question you are provided with the class `Student` that has at least three methods available to you. `getScore()` returns the student's score. `isAttendanceGood()` returns true if the student has good attendance, false otherwise. `isTalkative()` returns true if the student is talkative in class, false otherwise. The signature of these methods are given below:

```
public int getScore()  
public boolean isAttendanceGood()  
public boolean isTalkative()
```

Note that the class may have more data members or methods that are not reflected here. You are asked to write a method `printGrade` with the following signature:

```
void printGrade(Student s1);
```

As the name suggests, this method takes an object of type `Student` and prints out the final grade for that student. The grade is assigned following these guidelines.

- (a) There are only 3 possible grades A, B or C.
- (b) If a student has a score of more than 80, they have an A.
- (c) If a student has a score of more than 60 but less than 80, they have a B.
- (d) If a student has a score of less than 60 they have a C.
- (e) Students that fall on the boundary of an A and a B (i.e., a score of exactly 80) receive an A only if they have good attendance, and a B otherwise.
- (f) Students that fall on the boundary of a B and a C (i.e., a score of exactly 60) receive a C only if they are talkative in class, and a B otherwise.

Note: Write your code on the next page.

Solution for programming question 3:

```
void printGrade(Student s1)
{
    int score = s1.getScore();

    if (score >= 80)
    {
        if (score == 80)
        {
            if (s1.goodAttendance())
            {
                System.out.println("A");
            }
            else
            {
                System.out.println("B");
            }
        }
        else
        {
            System.out.println("A");
        }
    }
    else if (score < 80 && score >= 60)
    {
        if (score == 60)
        {
            if (s1.talkative())
            {
                System.out.println("C");
            }
            else
            {
                System.out.println("B");
            }
        }
        else
        {
            System.out.println("B");
        }
    }
    else if (score < 60)
    {
        System.out.println("C");
    }
}
```