**Chapter 3: Using Classes and Objects**

**Multiple Choice Questions**:

1) A special method that is invoked to set up an object during instantiation is called a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

a) new method

b) dot operator

c) creator

d) constructor

e) destructor

Answer: d

Explanation: The constructor is called to set up an object during instantiation. The dot operator is used to access methods of an object. There is no "new" method – new is an operator. Java also does not have "creators" or "destructors."

2) Which of the following is an *invalid* way to instantiate a String object?

1. String title = new String("Java Software Solutions");
2. String name = "John Lewis";
3. String empty = "";
4. String alsoEmpty = new String("");
5. all of the above are valid

Answer: e

Explanation: Choices a and d represent the standard approach to instantiating a String object. Choice d creates the emptry string. Choices b and c use a shortcut notation that is only available for creating a String object.

3) Assume that we have a Random object referenced by a variable called generator. Which of the following lines will generate a random number in the range 5-20 and store it in the int variable randNum?

1. randNum = generator.nextInt(15) + 5;
2. randNum = generator.nextInt(15) + 6;
3. randNum = generator.nextInt(16) + 5;
4. randNum = generator.nextInt(16) + 6;
5. none of the above

Answer: c

Explanation: When called with 16 as a parameter, the nextInt() method will return a number in the range 0 to 15. Adding 5 to this random number will generate a number in the range 5 to 20.

4) Which of the following classes include the getCurrencyInstance() method?

1. String
2. NumberFormat
3. DecimalFormat
4. Math
5. none of the above

Answer: b

Explanation: The NumberFormat class includes the getCurrencyInstance() method.

5) Which of the following expressions correctly computes the value of the mathematical expression 5 + 26?

1. result = 5 + 2^6;
2. result = 5 + 2\*exponent(6);
3. result = 5 + 2\*Math.exponent(6);
4. result = 5 + Math.pow(2, 6);
5. none of the above

Answer: d

Explanation: Choice a is wrong because Java does not have an exponential operator for primitive types. Choices b and C are wrong because there are no methods named exponent in the java.lang package or the Math class. Choice c correctly uses the Math.pow() method to compute the expression.

6) Consider the following snippet of code:

Random generator = new Random();

int randNum = generator.nextInt(20) + 1;

Which of the following will be true after these lines are executed?

1. randNum will hold a number between 1 and 20 inclusive.
2. randNum will hold a number between 0 and 20 inclusive.
3. randNum will hold a number between 1 and 21 inclusive.
4. these lines will not be executed because a compiler error will result.
5. none of the above

Answer: a

Explanation: When called with a parameter of 20, the nextInt() method will return an integer between 0 and 19 inclusive. Adding one to this will result in a number between 1 and 20 inclusive.

7) Which of the following represents the proper way to create a NumberFormat object that formats numbers as percentages?

1. NumberFormat fmt = new NumberFormat(%);
2. NumberFormat fmt = new NumberFormat("%");
3. NumberFormat fmt = NumberFormat.getPercentInstance();
4. NumberFormat fmt = new PercentNumberFormat();
5. none of the above

Answer: c

Explanation: The NumberFormat class uses factory methods to construct objects. The new operator is called implicitly in this case. The factory method that is used is called getPercentInstance(). Therefore choice c is correct. Choice a and Choice b are incorrect since they call the new operator explicitly. Choice d is incorrect because there is no PercentNumberFormat class that can be called with the new constructor.

8) Which of the following is a correct declaration of enumerated type for the suits of a deck of cards?

1. enumerated type Suit = { hearts, spades, diamonds, clubs };
2. enum Suit {hearts, spades, diamonds, clubs };
3. enum Suit {hearts, spades, diamonds, clubs }
4. enumerated type Suit = {hearts, spades, diamonds, clubs };
5. enum Suit = { hearts, spades, diamonds, clubs }

Answer: c

Explanation: Choice c represents the correct syntax for declaring an enumerated type called Suit that can take one of the values hearts, spades, diamonds or clubs.

9) Fruit is an enumerated type with values apple, banana, grape, and orange, in that order. Which of the following statements assigns the value orange to the Fruit variable snack?

1. snack = orange;
2. Fruit.snack = orange;
3. snack = Fruit.orange;
4. snack =Fruit.last();
5. snack = Fruit(4);

Answer: c

Explanation: Values are assigned to enumerated type variables by using the typename, the dot operator, and the type value.

10) newNum is an Integer object that holds an int value. Which expression below returns the value in newNum as a double value?

1. newNum.doubleValue()
2. newNum.double();
3. newNum.toDouble();
4. Double.newNum();
5. There is no way to return the value as a double.

Answer: a

Explanation: The doubleValue() method of the Integer class returns the value of an object as a double.

11) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the automatic conversion between a primitive value and a corresponding wrapper object.

a) Generating

b) Aliasing

c) Number formatting

d) Static invocation

e) Autoboxing

Answer: e

Explanation: Autoboxing allows a programmer to automatically convert between a primitive value and a corresponding wrapper object. The other 4 answers are incorrect.

12) Which of the following best describes what happens when an object no longer has any references pointing to it?

a) The object is overwritten the next time the new operator is called.

b) The object is overwritten the next time the new operator is called using the same class.

c) The object is immediately deleted from memory.

d) The object is marked as garbage and its associated memory is freed when the garbage collector runs.

e) The object stays in memory for the remainder of the programs execution.

Answer: d

Explanation: Java has automatic garbage collection. When an object no longer has any references pointing to it, it is marked as garbage. When the garbage collector runs, the memory is freed so that new objects can be created in its space.

13) Suppose we have a String object referenced by a variable called listing. Suppose we want a new String object that consists of the first 5 characters in listing. Which of the following lines of code will achieve this?

1. String prefix = listing.front(5);
2. String prefix = listing.front(6);
3. String prefix = listing.substring(1,5);
4. String prefix = listing.substring(0,5);
5. String prefix = listing.firstChars(5);

Answer: d

Explanation: Choices a, b, and e are wrong because the String class does not have methods called front or firstChars. Choice c is incorrect because the first character in the string is indexed by 1. Choice c is correct, since it will create a new string from the first 5 characters of listing.

14) When two references point to the same object, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

a) a run-time error will occur.

b) a compiler error will occur.

c) the references are called *aliases* of each other.

d) the object will be marked for garbage collection.

e) the references are called *null* references.

Answer: c

Explanation: It is perfectly acceptable to have two references pointing to the same object, so no errors will be generated. Therefore choices a and b are incorrect. Choice d is incorrect since objects are marked for garbage collection only when *no* references point to them. Choice e is incorrect since references are called *null* when they do not point to anything.

15) The String class \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

a) is part of the java.lang package.

b) is part of the java.util package.

c) is a wrapper class.

d) none of the above.

e) all of the above.

Answer: a

Explanation: The String class is part of the java.lang package. Therefore, choice a is the correct answer. It is not a wrapper class, and it is not part of the java.util package, therefore the other choices are wrong.**True/False Questions**:

1) Multiple reference variables can refer to the same object.

Answer: True

Explanation: When multiple reference variables refer to the same object, they are called *aliases* of each other.

2) The new operator is used to access an object's methods.

Answer: False

Explanation: The new operator is used to instantiate objects. The dot operator is used to access an objects methods.

3) A variable that is declared as a primitive type stores the actual value of the associated data. A variable that is declared as an object type stores a pointer to the associated object.

Answer: True

Explanation: Primitive data types are stored by value, object types are stored by reference.

4) The value of a primitive datatype variable may be assigned to an object of the corresponding wrapper class, and vice-versa.

Answer: True

Explanation: Autoboxing and unboxing allow the conversion between primitive datatypes and wrapper objects of the corresponding classes. Such assignments are generally not possible without classes that support autoboxing and unboxing.

5) String objects can be changed after instantiation.

Answer: False

Explanation: String objects are immutable, meaning that once a String object is created, its value cannot be lengthened or shortened, nor can any of its characters change.

6) All of the classes contained in the java.util package are automatically included in every Java program.

Answer: False

Explanation: In order to use classes in the java.util package, the programmer must include them using an import statement. The classes in the java.lang package are automatically included in every Java program, and therefore do not require an import statement to use.

7) When called with integer parameter n, the nextInt() method of the Random class will return a randomly generated integer between 0 and n.

Answer: False

Explanation: When called with integer parameter n, the nextInt() method of the Random class will return a randomly generated integer between 0 and n-1.

8) The Math class is part of the java.lang package.

Answer: True

Explanation: The Math class is part of the java.lang package. Therefore, a programmer does not need to include an explicit import statement to use its methods.

9) Enumerated types allow a programmer to treat primitive data as objects.

Answer: False

Explanation: Enumerated types are programmer-defined types that allow variables to be assigned values from a specified set. Wrapper classes allow a programmer to treat primitive data as objects.

10) The System.out.printf() method is an alternative way to output information in Java.

Answer: True

Explanation: The System.out.printf() method provides an alternative way of outputting data, but was mainly incorporated into Java to make it easier to port legacy programs written in C to the Java language.**Short Answer Questions**:

1) Explain how variables representing objects and variables representing primitive types are different.

Answer: A variable representing a primitive type actually holds the primitive value associated with the variable, while a variable representing an object holds a reference to the object associated with the variable.

2) Suppose we have a String object called myString. Write a single line of Java code that will output myString in such a way that all of its characters are uppercase.

Answer:

System.out.println(myString.toUpperCase());

3) Explain what it means for a String object to be *immutable*. Are there any workarounds for this?

Answer: String objects are immutable, meaning that once a String object is created, its value cannot be lengthened or shortened, nor can any of its characters change. However, there are several methods in the String class that return new modified String objects. By reassigning the original reference to the result of calling one of these methods, we can effectively change the value of a String object.

4) Write a short program that allows the user to input a positive integer and then outputs a randomly generated integer between 1 and the input number.

Answer:

import java.util.Scanner;

import java.util.Random;

public class RandomInteger {

public static void main(String [] args) {

int inputNum, randNum;

Scanner input = new Scanner(System.in);

Random generator = new Random();

System.out.print("Please enter a positive integer: ");

inputNum = input.nextInt();

randNum = generator.nextInt(inputNum) + 1;

System.out.println("Your random number is " + randNum + ".");

}//end main

}//end class

5) Write a statement that computes the square root of a variable called discriminant and stores the value in a variable called result.

Answer:

result = Math.sqrt(discriminant);

6) After an object is instantiated and associated with a reference variable, how are the object's methods accessed? Give an example.

Answer: The name of the reference variable and the dot operator are used to access the object's methods.

Example:

Integer num = new Integer(12);

// Invoke the println() method of the System.out object

// and the toHexString() method of the num object

System.out.println(num.toHexString());

7) generator is an object of the Random class. Write a single statement that generates a random number in the range 73 to 100 and assigns it to int variable randNum.

Answer:

randNum = generator.nextInt(28) + 73;

8) What is the range of integers that will be generated by the following expression?

generator.nextInt(15) + 5

Answer: This expression will generate a random number in the range 5 to 19 (inclusive).

9) Write an expression that will compute the tangent of an angle stored in a variable named angle, and put the resulting value in a variable named tangent.

Answer:

tangent = Math.tan(angle);

10) Write a declaration for an enumerated type that represents the months of the year.

Answer:

enum Month { January, February, March, April, May, June, July, August, September, October, November, December }

11) Write a single statement that creates a DecimalFormat object that formats numbers to 2 decimal places.

Answer:

DecimalFormat fmt = new DecimalFormat("0.##");

12) Write a short program that allows the user to enter the base and height of a triangle and outputs the hypotenuse, formatted to three decimal places.

Answer:

import java.util.Scanner;

import java.text.DecimalFormat;

public class Hypotenuse {

public static void main(String [] args) {

double base, height, hypotenuse;

Scanner input = new Scanner(System.in);

DecimalFormat fmt = new DecimalFormat("0.###");

System.out.print("Please enter the base: ");

base = input.nextDouble();

System.out.print("Please enter the height: ");

height = input.nextDouble();

hypotenuse = Math.sqrt(Math.pow(base,2) + Math.pow(height,2));

System.out.println("The hypotenuse is " + fmt.format(hypotenuse)

+ ".");

}//end main

}//end class

13) A program will use a Scanner object from java.util.Scanner and a Random object from java.util.Random. Write a single import statement that will support the program.

Answer:

import java.util.\*;

14) Write a single line that creates a wrapper object named numWrapper for an int variable named num.

Answer:

Integer numWrapper = new Integer(num);

15) Write an expression that computes 12 raised to the power 4.3 and store the result in a double called result.

Answer:

result = Math.pow(12, 4.3);