## 1. Java Building Blocks

public class Zoo {

public static void main(String[] args) {

System.out.println(args[0]);

System.out.println(args[1]);

} }

The program correctly identifies the first two “words” as the arguments. Spaces are used to separate the arguments. If you want spaces inside an argument, you need to use quotes as in this example:

$ javac Zoo.java

$ java Zoo "San Diego" Zoo

All command-line arguments are treated as String objects, even if they represent another data type:

$ javac Zoo.java

$ java Zoo Zoo 2

Finally, what happens if you don’t pass in enough arguments?

$ javac Zoo.java

$ java Zoo Zoo

Zoo

**Exception in thread "main" java.lang.ArrayIndexOutOfBoundsException: 1 at mainmethod.Zoo.main(Zoo.java:7)**

public class Conflicts {

Date date;

// some more code

}

The answer should be easy by now. You can write either import java.util.\*; or import java.util.Date;. The tricky cases come about when other imports are present:

import java.util.\*;

import java.sql.\*; // DOES NOT COMPILE

import java.util.Date;

import java.sql.\*;

If you explicitly import a class name, it takes precedence over any wildcards present.

■ octal (digits 0–7), which uses the number 0 as a prefix—for example, 017

■ hexadecimal (digits 0–9 and letters A–F), which uses the number 0 followed by x or X as a prefix—for example, 0xFF

■ binary (digits 0–1), which uses the number 0 followed by b or B as a prefix—for example, 0b10

System.out.println(56); // 56

System.out.println(0b11); // 3

System.out.println(017); // 15

System.out.println(0x1F); // 31

added in Java 7. You can have underscores in numbers to make them easier to read:

int million1 = 1000000;

int million2 = 1\_000\_000;

double notAtStart = \_1000.00; // DOES NOT COMPILE

double notAtEnd = 1000.00\_; // DOES NOT COMPILE

double notByDecimal = 1000\_.00; // DOES NOT COMPILE

double annoyingButLegal = 1\_00\_0.0\_0; // this one compiles

**Declaring Multiple Variables**

int i1, i2, i3 = 0;

As you should expect, three variables were declared: i1, i2, and i3. However, only one of those values was initialized: i3. The other two remain declared but not yet initialized.

int num, String value; // DOES NOT COMPILE

This code doesn’t compile because it tries to declare multiple variables of different types in the same statement.

double d1, double d2; // DOES NOT COMPILE

If you want to declare multiple variables in the same statement, they must share the same type declaration and not repeat it. double d1, d2; would have been legal.

boolean b1, b2;

String s1 = "1", s2;

double d1, double d2;

int i1; int i2;

int i3; i4;

The first statement is legal. It declares two variables without initializing them. second statement is also legal. It declares two variables and initializes only one of them. The third statement is not legal. Variables d1 and d2 are the same type & breaks between them.

The fourth statement is legal.The fifth statement is not legal.The second one is not a valid declaration because it omits the type.

**Garbage Collection**

1: public class Scope {

2: public static void main(String[] args) {

3: String one, two;

4: one = new String("a");

5: two = new String("b");

6: one = two;

7: String three = one;

8: one = null;

9: } }

Questions

6. Given the following classes, what is the maximum number of imports that can be removed and have the code still compile?

package aquarium; public class Water { }

package aquarium;

import java.lang.\*;

import java.lang.System;

import aquarium.Water;

import aquarium.\*;

public class Tank {

public void print(Water water) {

System.out.println(water); } }

A. 0

B. 1

C. 2

D. 3

E. 4

F. Does not compile.

E. The first two imports can be removed because java.lang is automatically imported.The second two imports can be removed because Tank and Water are in the same package,making the correct answer E. If Tank and Water were in different packages, one of

these two imports could be removed. In that case, the answer would be option D.

7. Given the following classes, which of the following snippets can be inserted in place of INSERT IMPORTS HERE and have the code compile? (Choose all that apply)

package aquarium;

public class Water {

boolean salty = false;

}

package aquarium.jellies;

public class Water {

boolean salty = true;

}

package employee;

INSERT IMPORTS HERE

public class WaterFiller {

Water water;

}

A. import aquarium.\*;

B. import aquarium.Water;

import aquarium.jellies.\*;

C. import aquarium.\*;

import aquarium.jellies.Water;

D. import aquarium.\*;

import aquarium.jellies.\*;

E. import aquarium.Water;

import aquarium.jellies.Water;

F. None of these imports can make the code compile

A, B, C. Option A is correct because it imports all the classes in the aquarium package including aquarium.Water. Options B and C are correct because they import Water by classname. Since importing by classname takes precedence over wildcards, these compile.

Option D is incorrect because Java doesn’t know which of the two wildcard Water classes to use. Option E is incorrect because you cannot specify the same classname in two imports.

10. Which of the following are legal entry point methods that can be run from the command line? (Choose all that apply)

A. private static void main(String[] args)

B. public static final main(String[] args)

C. public void main(String[] args)

D. public static void test(String[] args)

E. public static void main(String[] args)

F. public static main(String[] args)

G. None of the above

E. Option E is the canonical main() method signature. You need to memorize it.Option A is incorrect because the main() method must be public. Options B and F are incorrect because the main() method must have a void return type. Option C is

incorrect because the main() method must be static. Option D is incorrect because the main() method must be named main.

12. Which of the following are true? (Choose all that apply)

A. A local variable of type boolean defaults to null.

B. A local variable of type float defaults to 0.

C. A local variable of type Object defaults to null.

D. A local variable of type boolean defaults to false.

E. A local variable of type boolean defaults to true.

F. A local variable of type float defaults to 0.0.

G. None of the above.

G. Option G is correct because local variables do not get assigned default values. The code fails to compile if a local variable is not explicitly initialized. If this question were about instance variables, options D and F would be correct. A boolean primitive

defaults to false and a float primitive defaults to 0.0

19. Suppose we have a class named Rabbit. Which of the following statements are true?(Choose all that apply)

1: public class Rabbit {

2: public static void main(String[] args) {

3: Rabbit one = new Rabbit();

4: Rabbit two = new Rabbit();

5: Rabbit three = one;

6: one = null;

7: Rabbit four = one;

8: three = null;

9: two = null;

10: two = new Rabbit();

11: System.gc();

12: } }

A. The Rabbit object from line 3 is first eligible for garbage collection immediately

following line 6.

B. The Rabbit object from line 3 is first eligible for garbage collection immediately

following line 8.

C. The Rabbit object from line 3 is first eligible for garbage collection immediately

following line 12.

D. The Rabbit object from line 4 is first eligible for garbage collection immediately

following line 9.

E. The Rabbit object from line 4 is first eligible for garbage collection immediately

following line 11.

F. The Rabbit object from line 4 is first eligible for garbage collection immediately

following line 12.

B, D. The Rabbit object from line 3 has two references to it: one and three. The references are nulled out on lines 6 and 8, respectively. Option B is correct because this makes the object eligible for garbage collection after line 8. Line 7 sets the reference

four to the now null one, which means it has no effect on garbage collection. The Rabbit object from line 4 only has a single reference to it: two. Option D is correct because this single reference becomes null on line 9. The Rabbit object declared on line 10

becomes eligible for garbage collection at the end of the method on line 12. Calling System.gc() has no effect on eligibility for garbage collection.

## 2.Operators and Statements

System.out.print(9 / 3); // Outputs 3

System.out.print(9 % 3); // Outputs 0

System.out.print(10 / 3); // Outputs 3

System.out.print(10 % 3); // Outputs 1

System.out.print(11 / 3); // Outputs 3

System.out.print(11 % 3); // Outputs 2

System.out.print(12 / 3); // Outputs 4

System.out.print(12 % 3); // Outputs 0

**Numeric Promotion Rules**

1. If two values have different data types, Java will automatically promote one of the values to the larger of the two data types.

2. If one of the values is integral and the other is floating-point, Java will automatically promote the integral value to the floating-point value’s data type.

3. Smaller data types, namely byte, short, and char, are first promoted to int any time they’re used with a Java binary arithmetic operator, even if neither of the operands is int.

4. After all promotion has occurred and the operands have the same data type, the resulting value will have the same data type as its promoted operands.

What is the data type of x / y?

short x = 10;

short y = 3;

In this case, we must apply the third rule, namely that x and y will both be promoted to int before the operation, resulting in an output of type int.

What is the data type of x \* y / z?

short x = 14;

float y = 13;

double z = 30;

In this case, we must apply all of the rules. First, x will automatically be promoted to int solely because it is a short and it is being used in an arithmetic binary operation. The promoted x value will then be automatically promoted to a float so that it can be

multiplied with y. The result of x \* y will then be automatically.

int x = 3;

int y = ++x \* 5 / x-- + --x;

System.out.println("x is " + x);

System.out.println("y is " + y);

int y = 4 \* 5 / x-- + --x; // x assigned value of 4

int y = 4 \* 5 / 4 + --x; // x assigned value of 3

int y = 4 \* 5 / 4 + 2; // x assigned value of 2

we evaluate the multiple and division from left-to-right, and fi nish with the addition.The result is then printed:

x is 2

y is 7

long t = 192301398193810323; // DOES NOT COMPILE

It does not compile because Java interprets the literal as an int and notices that the value is larger than int allows. The literal would need a postfi x L to be considered a long

short x = 10;

short y = 3;

short z = x \* y; // DOES NOT COMPILE

short x = 10;

short y = 3;

short z = (short)(x \* y);

long x = 10;

int y = 5;

y = y \* x; // DOES NOT COMPILE

Based on the last two sections, you should be able to spot the problem in the last line.This last line could be fi xed with an explicit cast to (int), but there’s a better way using the compound assignment operator:

long x = 10;

int y = 5;

y \*= x;

The compound operator will first cast x to a long, apply the multiplication of two long values, and then cast the result to an int.

long x = 5;

long y = (x=3);

System.out.println(x); // Outputs 3

System.out.println(y); // Also, outputs 3

**Equality Operators (==)**

The comparisons for equality are limited to these three cases, so you cannot mix and match types. For example, each of the following would result in a compiler error:

boolean x = true == 3; // DOES NOT COMPILE

boolean y = false != "Giraffe"; // DOES NOT COMPILE

boolean z = 3 == "Kangaroo"; // DOES NOT COMPILE

**Conditional Statements**

int x = 1;

if(x) { // DOES NOT COMPILE

...

}

int x = 1;

if(x = 5) { // DOES NOT COMPILE

...

}

System.out.println((y > 5) ? 21 : "Zebra");

int animal = (y < 91) ? 9 : "Horse"; // DOES NOT COMPILE

^ (X-OR) - Homogenious are FALSE(T,T F,F), Hertrogenious are TRUE(T,F F,T)

QUESTIONS

9. How many times will the following code print "Hello World"?

3: for(int i=0; i<10 ; ) {

4: i = i++;

5: System.out.println("Hello World");

6: }

A. 9

B. 10

C. 11

D. The code will not compile because of line 3.

E. The code will not compile because of line 5.

F. The code contains an infinite loop and does not terminate.

F. In this example, the update statement of the for loop is missing, which is fine as the statement is optional, so option D is incorrect. The expression inside the loop increments i but then assigns i the old value. Therefore, i ends the loop with the same value

that it starts with: 0. The loop will repeat infinitely, outputting the same statement over and over again because i remains 0 after every iteration of the loop.

10. What is the output of the following code?

3: byte a = 40, b = 50;

4: byte sum = (byte) a + b;

5: System.out.println(sum);

A. 40

B. 50

C. 90

D. The code will not compile because of line 4.

E. An undefined value.

D. Line 4 generates a possible loss of precision compiler error. The cast operator has the highest precedence, so it is evaluated first, casting a to a byte. Then, the addition is evaluated, causing both a and b to be promoted to int values. The value 90 is an int

and cannot be assigned to the byte sum without an explicit cast, so the code does not compile. The code could be corrected with parentheses around (a + b), in which case option C would be the correct answer.

15. What is the output of the following code snippet?

3: int x = 1, y = 15;

4: while x < 10

5: y––;

6: x++;

7: System.out.println(x+", "+y);

A. 10, 5

B. 10, 6

C. 11, 5

D. The code will not compile because of line 3.

E. The code will not compile because of line 4.

F. The code contains an infinite loop and does not terminate

E. This is actually a much simpler problem than it appears to be. The while statement on line 4 is missing parentheses, so the code will not compile, and option E is the correct answer. If the parentheses were added, though, option F would be the correct

answer since the loop does not use curly braces to include x++ and the boolean expression never changes. Finally, if curly braces were added around both expressions, the output would be 10, 6 and option B would be correct.

2. What data type (or types) will allow the following code snippet to compile? (Choose all that apply)

byte x = 5;

byte y = 10;

\_\_\_\_\_ z = x + y;

A. int

B. long

C. boolean

D. double

E. short

F. byte

A, B, D. The value x + y is automatically promoted to int, so int and data types that can be promoted automatically from int will work. Options A, B, D are such data types. Option C will not work because boolean is not a numeric data type. Options E and F will not work without an explicit cast to a smaller data type.

## 3. APIs-Arrays-String-Date

1. If both operands are numeric, + means numeric addition.

2. If either operand is a String, + means concatenation.

3. The expression is evaluated left to right.

Now let’s look at some examples:

System.out.println(1 + 2); // 3

System.out.println("a" + "b"); // ab

System.out.println("a" + "b" + 3); // ab3

System.out.println(1 + 2 + "c"); // 3c

System.out.println(string.substring(3, 3)); // empty string

System.out.println(string.substring(3, 2)); // throws exception

System.out.println(string.substring(3, 8)); // throws exception

3: StringBuilder sb = new StringBuilder("animals");

4: sb.insert(7, "-"); // sb = animals-

5: sb.insert(0, "-"); // sb = -animals-

6: sb.insert(4, "-"); // sb = -ani-mals

7: System.out.println(sb);

**Understanding Equality**

StringBuilder one = new StringBuilder();

StringBuilder two = new StringBuilder();

StringBuilder three = one.append("a");

System.out.println(one == two); // false

System.out.println(one == three); // true

StringBuilder methods like to return the current reference for chaining? This means one and three both point to the same object and

the second print statement gives us true

String x = "Hello World";

String y = "Hello World";

System.out.println(x == y); // true

Remember that Strings are immutable and literals are pooled. The JVM created only one literal in memory. x and y both point to the same location in memory; therefore, the statement outputs true. It gets even trickier. Consider this code:

String x = "Hello World";

String z = " Hello World".trim();

System.out.println(x == z); // false

In this example, we don’t have two of the same String literal. Although x and z happen to evaluate to the same string, one is computed at runtime. Since it isn’t the same at compile-time, a new String object is created.

**Arrays**

you can type the [] before or after the name, and adding a space is optional.This means that all four of these statements do the exact same thing:

int[] numAnimals;

int [] numAnimals2;

int numAnimals3[];

int numAnimals4 [];

**Sorting**

Arrays is the fi rst class provided by Java we have used that requires an import. To use it, you must have either of the following two statements in your class:

import java.util.\* // import whole package including Arrays

import java.util.Arrays; // import just Arrays

This simple example sorts three numbers:

int[] numbers = { 6, 9, 1 };

Arrays.sort(numbers);

for (int i = 0; i < numbers.length; i++)

System.out.print (numbers[i] + " "); //1 6 9,

String[] strings = { "10", "9", "100" };

Arrays.sort(strings);

for (String string : strings)

System.out.print(string + " ");//10 100 9.

String sorts in alphabetic order, and 1 sorts before 9. (Numbers sort before letters and uppercase sorts before lowercase, in case you were wondering.)

**Searching**

Java also provides a convenient way to search—but only if the array is already sorted.

**Target element found in sorted array** -Index of match

**Target element not found in sorted array** -Negative value where a match needs to be inserted to preserve sorted order

**Unsorted array A surprise** —this result isn’t predictable

3: int[] numbers = {2,4,6,8};

4: System.out.println(Arrays.binarySearch(numbers, 2)); // 0

5: System.out.println(Arrays.binarySearch(numbers, 4)); // 1

6: System.out.println(Arrays.binarySearch(numbers, 1)); // -1

7: System.out.println(Arrays.binarySearch(numbers, 3)); // -2

8: System.out.println(Arrays.binarySearch(numbers, 9)); // -5

5: int numbers = new int[] {3,2,1};

6: System.out.println(Arrays.binarySearch(numbers, 2));

7: System.out.println(Arrays.binarySearch(numbers, 3));

Note that on line 5, the array isn’t sorted. This means the output will not be predictable.

**ArrayList**

ArrayList is an ordered sequence that allows duplicates.

import java.util.\* // import whole package including ArrayList

import java.util.ArrayList; // import just ArrayList

**Creating an ArrayList:**

As with StringBuilder, there are three ways to create an ArrayList:

ArrayList list1 = new ArrayList();

ArrayList list2 = new ArrayList(10);

ArrayList list3 = new ArrayList(list2);

Java 5 introduced generics, which allow you to specify the type of class that the ArrayList will contain.

ArrayList<String> list4 = new ArrayList<String>();

ArrayList<String> list5 = new ArrayList<>();

Java 5 allows you to tell the compiler what the type would be by specifying it between <and >. **in Java 7, you can omit that type from the right side. The < and >** are still required, though. This is called the diamond operator because <> looks like a diamond.

List<String> list6 = new ArrayList<>();

ArrayList<String> list7 = new List<>(); // DOES NOT COMPILE

**boolean add(E element)**

**void add(int index, E element)**

ArrayList list = new ArrayList();

list.add("hawk"); // [hawk]

list.add(Boolean.TRUE); // [hawk, true]

System.out.println(list); // [hawk, true]

ArrayList<String> safer = new ArrayList<>();

safer.add("sparrow");

safer.add(Boolean.TRUE); // DOES NOT COMPILE

4: List<String> birds = new ArrayList<>();

5: birds.add("hawk"); // [hawk]

6: birds.add(1, "robin"); // [hawk, robin]

7: birds.add(0, "blue jay"); // [blue jay, hawk, robin]

8: birds.add(1, "cardinal"); // [blue jay, cardinal, hawk, robin]

9: System.out.println(birds); // [blue jay, cardinal, hawk, robin]

**boolean remove(Object object)**

**E<Object> remove(int index)**

3: List<String> birds = new ArrayList<>();

4: birds.add("hawk"); // [hawk]

5: birds.add("hawk"); // [hawk, hawk]

6: System.out.println(birds.remove("cardinal")); // prints false

7: System.out.println(birds.remove("hawk")); // prints true

8: System.out.println(birds.remove(0)); // prints hawk

9: System.out.println(birds); // []

The set() method changes one of the elements of the ArrayList without changing the size.

**E set(int index, E newElement)**

The E return type is the element that got replaced.

15: List<String> birds = new ArrayList<>();

16: birds.add("hawk"); // [hawk]

17: System.out.println(birds.size()); // 1

18: birds.set(0, "robin"); // [robin]

19: System.out.println(birds.size()); // 1

20: birds.set(1, "robin"); // IndexOutOfBoundsException

**boolean isEmpty()**

**int size()**

System.out.println(birds.isEmpty()); // true

System.out.println(birds.size()); // 0

birds.add("hawk"); // [hawk]

birds.add("hawk"); // [hawk, hawk]

System.out.println(birds.isEmpty()); // false

System.out.println(birds.size()); // 2

**void clear()**

The clear() method provides an easy way to discard all elements of the ArrayList. The

List<String> birds = new ArrayList<>();

birds.add("hawk"); // [hawk]

birds.add("hawk"); // [hawk, hawk]

System.out.println(birds.isEmpty()); // false

System.out.println(birds.size()); // 2

birds.clear(); // []

System.out.println(birds.isEmpty()); // true

System.out.println(birds.size()); // 0

**boolean contains(Object object)**

List<String> birds = new ArrayList<>();

birds.add("hawk"); // [hawk]

System.out.println(birds.contains("hawk")); // true

System.out.println(birds.contains("robin")); // false

**equals()**

Finally, ArrayList has a custom implementation of equals() so you can compare two lists to see if they contain the same elements in the same order.

**boolean equals(Object object)**

31: List<String> one = new ArrayList<>();

32: List<String> two = new ArrayList<>();

33: System.out.println(one.equals(two)); // true

34: one.add("a"); // [a]

35: System.out.println(one.equals(two)); // false

36: two.add("a"); // [a]

37: System.out.println(one.equals(two)); // true

38: one.add("b"); // [a,b]

39: two.add(0, "b"); // [b,a]

40: System.out.println(one.equals(two)); // false

Converting Between array and List

**ArrayList into an array:(toArray())**

3: List<String> list = new ArrayList<>();

4: list.add("hawk");

5: list.add("robin");

6: Object[] objectArray = list.toArray();

7: System.out.println(objectArray.length); // 2

8: String[] stringArray = list.toArray(new String[0]);

9: System.out.println(stringArray.length); // 2

Line 6 shows that an ArrayList knows how to convert itself to an array. The only problem is that it defaults to an array of class Object.

Line 8 specifies the type of the array as String, size of 0 for the parameter is that Java will create a new array of the proper size for the return value.

**Array to a List:(asList())**

The original array and created array backed List(A List elements can Replace , not Remove)

20: String[] array = { "hawk", "robin" }; // [hawk, robin]

21: List<String> list = Arrays.asList(array); // returns fixed size list

22: System.out.println(list.size()); // 2

23: list.set(1, "test"); // [hawk, test]

24: array[0] = "new"; // [new, test]

25: for (String b : array) System.out.print(b + " "); // new test

26: list.remove(1); // throws UnsupportedOperation Exception

Line 21 converts the array to a List. Note that it isn’t the java.util.ArrayList we’ve grown used to. It is a fi xed-size, backed version of a List. Line 23 is okay because set() merely replaces an existing value. It updates both array and list because they point to the

same data store. Line 24 also changes both array and list. Line 25 shows the array has changed to new test. Line 26 throws an exception because we are not allowed to change the size of the list.

**List<String> list = Arrays.asList("one", "two");**

**asList()** takes varargs, which let you pass in an array or just type out the String values. This is handy when testing because you can easily create and populate a List on one line.

**Sorting**

Sorting an ArrayList is very similar to sorting an array. You just use a different helper class:

List<Integer> numbers = new ArrayList<>();

numbers.add(99);

numbers.add(5);

numbers.add(81);

Collections.sort(numbers);

System.out.println(numbers); [5, 81, 99]

**Date & Time API (java.time.\*;)**

\*\*\*\*\* Dates are immutable

\*\*\*\*\* Period does not allow chaining.But No Compile & Runtime Errors. Only the last Period method called counts.

LocalDate date1 = LocalDate.of(2015, Month.JANUARY, 20);

LocalTime time1 = LocalTime.of(6, 15);

Finally, we can combine dates and times:

LocalDateTime dateTime1 = LocalDateTime.of(2015, Month.JANUARY, 20, 6, 15, 30);

LocalDateTime dateTime2 = LocalDateTime.of(date1, time1);

LocalDate d = new LocalDate(); // DOES NOT COMPILE

You are not allowed to construct a date or time object directly.

LocalDate.of(2015, Month.JANUARY, 32) // throws DateTimeException

java.time.DateTimeException: Invalid value for DayOfMonth:(valid values 1 - 28/31): 32

LocalDate date = LocalDate.of(2020, Month.JANUARY, 20);

date = date.plusMinutes(1); // DOES NOT COMPILE

LocalDate does not contain time. This means you cannot add minutes to it.

**Periods**

LocalDate start = LocalDate.of(2015, Month.JANUARY, 1);

LocalDate end = LocalDate.of(2015, Month.MARCH, 30);

public static void main(String[] args) {

LocalDate start = LocalDate.of(2015, Month.JANUARY, 1);

LocalDate end = LocalDate.of(2015, Month.MARCH, 30);

Period period = Period.ofMonths(1); // create a period

performAnimalEnrichment(start, end, period);

}

private static void performAnimalEnrichment(LocalDate start, LocalDate end,

Period period) { // uses the generic period

LocalDate upTo = start;

while (upTo.isBefore(end)) {

System.out.println("give new toy: " + upTo);

upTo = upTo.plus(period); // adds the period

}}

The method can add an arbitrary period of time that gets passed in. This allows us to reuse the same method for different periods of time as our zookeeper changes her mind.

**There are five ways to create a Period class:**

Period annually = Period.ofYears(1); // every 1 year

Period quarterly = Period.ofMonths(3); // every 3 months

Period everyThreeWeeks = Period.ofWeeks(3); // every 3 weeks

Period everyOtherDay = Period.ofDays(2); // every 2 days

Period everyYearAndAWeek = Period.of(1, 0, 7); // every year and 7 days

You cannot chain methods when creating a Period. Only the last method is used because the Period.ofXXX methods are static methods.

Period wrong = Period.ofYears(1).ofWeeks(1); // every week

3: LocalDate date = LocalDate.of(2015, 1, 20);

4: LocalTime time = LocalTime.of(6, 15);

5: LocalDateTime dateTime = LocalDateTime.of(date, time);

6: Period period = Period.ofMonths(1);

7: System.out.println(date.plus(period)); // 2015-02-20

8: System.out.println(dateTime.plus(period)); // 2015-02-20T06:15

9: System.out.println(time.plus(period)); // UnsupportedTemporalTypeException

Lines 7 and 8 work as expected. They add a month to January 20, 2015, giving us February 20, 2015. The fi rst has only the date, and the second has both the date and time. Line 9 attempts to add a month to an object that only has a time.

**Formatting Dates and Times**

**DateTimeFormatter** can be used to format any type of date and/or time object. DateTimeFormatter is in the package java.time.format.

LocalDate date = LocalDate.of(2020, Month.JANUARY, 20);

LocalTime time = LocalTime.of(11, 12, 34);

LocalDateTime dateTime = LocalDateTime.of(date, time);

System.out.println(date.format(DateTimeFormatter.ISO\_LOCAL\_DATE));// 2020-01-20

System.out.println(time.format(DateTimeFormatter.ISO\_LOCAL\_TIME));// 11:12:34

System.out.println(dateTime.format(DateTimeFormatter.ISO\_LOCAL\_DATE\_TIME));// 2020-01-20T11:12:34

DateTimeFormatter shortDateTime = DateTimeFormatter.ofLocalizedDate(FormatStyle.SHORT);

System.out.println(shortDateTime.format(dateTime)); // 1/20/20

System.out.println(shortDateTime.format(date)); // 1/20/20

System.out.println(shortDateTime.format(time)); // UnsupportedTemporalTypeException

DateTimeFormatter shortF = DateTimeFormatter.ofLocalizedDateTime(FormatStyle.SHORT);

DateTimeFormatter mediumF = DateTimeFormatter.ofLocalizedDateTime(FormatStyle.MEDIUM);

System.out.println(shortF.format(dateTime)); // 1/20/20 11:12 AM

System.out.println(mediumF.format(dateTime)); // Jan 20, 2020 11:12:34// AM

// If you don’t want to use one of the predefined formats, you can create your own.

**//M outputs 1, MM outputs 01, MMM outputs Jan, and MMMM outputs January.**

DateTimeFormatter f = DateTimeFormatter.ofPattern("MMMM dd, yyyy, hh:mm");

System.out.println(dateTime.format(f)); // January 20, 2020, 11:12

DateTimeFormatter df = DateTimeFormatter.ofPattern("MM dd yyyy");

LocalDate d1 = LocalDate.parse("01 02 2015", df);

LocalTime t1 = LocalTime.parse("11:22");

System.out.println(d1); // 2015-01-02

System.out.println(t1); // 11:22

\*\*\*\* All substring(6,5), charAt(8) are index exceptions throws at Runtime & not at compile time

QUESTIONS

1. What is output by the following code? (Choose all that apply)

1: public class Fish {

2: public static void main(String[] args) {

3: int numFish = 4;

4: String fishType = "tuna";

5: String anotherFish = numFish + 1;

6: System.out.println(anotherFish + " " + fishType);

7: System.out.println(numFish + " " + 1);

8: } }

A. 4 1

B. 41

C. 5

D. 5 tuna

E. 5tuna

F. 51tuna

G. The code does not compile.

G. Line 5 does not compile. This question is checking to see if you are paying attention to the types. numFish is an int and 1 is an int. Therefore, we use numeric addition and get 5. The problem is that we can’t store an int in a String variable. Supposing line 5

said String anotherFish = numFish + 1 + "";. In that case, the answer would be options A and D. The variable defined on line 5 would be the string "5", and both output statements would use concatenation.

2. Which of the following are output by this code? (Choose all that apply)

3: String s = "Hello";

4: String t = new String(s);

5: if ("Hello".equals(s)) System.out.println("one");

6: if (t == s) System.out.println("two");

7: if (t.equals(s)) System.out.println("three");

8: if ("Hello" == s) System.out.println("four");

9: if ("Hello" == t) System.out.println("five");

A. one

B. two

C. three

D. four

E. five

F. The code does not compile.

A, C, D. The code compiles fine. Line 3 points to the String in the string pool. Line 4 calls the String constructor explicitly and is therefore a different object than s. Lines 5 and 7 check for object equality, which is true, and so print one and three. Line 6 uses

object reference equality, which is not true since we have different objects. Line 7 also compares references but is true since both references point to the object from the string pool. Finally, line 8 compares one object from the string pool with one that was explicitly constructed and returns false.

3. Which are true statements? (Choose all that apply)

A. An immutable object can be modified.

B. An immutable object cannot be modified.

C. An immutable object can be garbage collected.

D. An immutable object cannot be garbage collected.

E. String is immutable.

F. StringBuffer is immutable.

G. StringBuilder is immutable.

B, C, E. Immutable means the state of an object cannot change once it is created.Immutable objects can be garbage collected just like mutable objects. String is immutable.StringBuilder can be mutated with methods like append()

5. What is the result of the following code?

2: String s1 = "java";

3: StringBuilder s2 = new StringBuilder("java");

4: if (s1 == s2)

5: System.out.print("1");

6: if (s1.equals(s2))

7: System.out.print("2");

A. 1

B. 2

C. 12

D. No output is printed.

E. An exception is thrown.

F. The code does not compile

F. The question is trying to distract you into paying attention to logical equality versus object reference equality. It is hoping you will miss the fact that line 4 does not compile.

**Java does not allow you to compare String and StringBuilder using ==.**

10. What is the result of the following code? (Choose all that apply)

13: String a = "";

14: a += 2;

15: a += 'c';

16: a += false;

17: if ( a == "2cfalse") System.out.println("==");

18: if ( a.equals("2cfalse")) System.out.println("equals");

A. Compile error on line 14.

B. Compile error on line 15.

C. Compile error on line 16.

D. Compile error on another line.

E. ==

F. equals

G. An exception is thrown.

F. a += 2 expands to a = a + 2. A String concatenated with any other type gives a String. Lines 14, 15, and 16 all append to a, giving a result of "2cfalse". The if statement on line 18 returns false because the values of the two String objects are the same using object equality. The if statement on line 17 returns false because the two String objects are not the same in memory. One comes directly from the string pool and the other comes from building using String operations

15. Which of these array declarations is not legal? (Choose all that apply)

A. int[][] scores = new int[5][];

B. Object[][][] cubbies = new Object[3][0][5];

C. String beans[] = new beans[6];

D. java.util.Date[] dates[] = new java.util.Date[2][];

E. int[][] types = new int[];

F. int[][] java = new int[][];

C, E, F. Option C uses the variable name as if it were a type, which is clearly illegal.Options E , another diminesion on right side missing.F don’t specify any size. Dimensions of a multidimensional array, the first one is required.

16. Which of these compile when replacing line 8? (Choose all that apply)

7: char[]c = new char[2];

8: // INSERT CODE HERE

A. int length = c.capacity;

B. int length = c.capacity();

C. int length = c.length;

D. int length = c.length();

E. int length = c.size;

F. int length = c.size();

G. None of the above.

C. Arrays define a property called length. It is not a method, so parentheses are not allowed.

17. Which of these compile when replacing line 8? (Choose all that apply)

7: ArrayList l = new ArrayList();

8: // INSERT CODE HERE

A. int length = l.capacity;

B. int length = l.capacity();

C. int length = l.length;

D. int length = l.length();

E. int length = l.size;

F. int length = l.size();

F. The ArrayList class defines a method called size().

18. Which of the following are true? (Choose all that apply)

A. An array has a fixed size.

B. An ArrayList has a fixed size.

C. An array allows multiple dimensions.

D. An array is ordered.

E. An ArrayList is ordered.

F. An array is immutable.

G. An ArrayList is immutable

A, C, D, E. An array is not able to change size and can have multiple dimensions. Both an array and ArrayList are ordered and have indexes. Neither is immutable. The elements can change in value

19. Which of the following are true? (Choose all that apply)

A. Two arrays with the same content are equal.

B. Two ArrayLists with the same content are equal.

C. If you call remove(0) using an empty ArrayList object, it will compile successfully.

D. If you call remove(0) using an empty ArrayList object, it will run successfully.

B, C. An array does not override equals() and so uses object equality. ArrayList does override equals() and defines it as the same elements in the same order. The compiler does not know when an index is out of bounds and thus can’t give you a compiler

error. The code will throw an exception at runtime, though

23. What is the result of the following?

4: List<Integer> list = Arrays.asList(10, 4, -1, 5);

5: Collections.sort(list);

6: Integer array[] = list.toArray(new Integer[4]);

7: System.out.println(array[0]);

A. –1

B. 10

C. Compiler error on line 4.

D. Compiler error on line 5.

A. Line 4 creates a fixed size array of size 4. Line 5 sorts it. Line 6 converts it back to an array. The brackets aren’t in the traditional place, but they are still legal. Line 7 prints the first element, which is now –1.

25. What is the result of the following?

List<String> hex = Arrays.asList("30", "8", "3A", "FF");

Collections.sort(hex);

int x = Collections.binarySearch(hex, "8");

int y = Collections.binarySearch(hex, "3A");

int z = Collections.binarySearch(hex, "4F");

System.out.println(x + " " + y + " " + z);

A 0 1 –2

B. 0 1 –3

C. 2 1 –2

D. 2 1 –3

E. The code doesn’t compile.

D. After sorting, hex contains [30, 3A, 8, FF]. Remember that numbers sort before letters and strings sort alphabetically. This makes 30 come before 8. A binary search correctly finds 8 at index 2 and 3A at index 1. It cannot find 4F but notices it should be at index 2. The rule when an item isn’t found is to negate that index and subtract 1.Therefore, we get –2–1, which is –3.

27. What is the result of the following?

List<String> one = new ArrayList<String>();

one.add("abc");

List<String> two = new ArrayList<>();

two.add("abc");

if (one == two)

System.out.println("A");

else if (one.equals(two))

System.out.println("B");

else

System.out.println("C");

A. A

B. B

C. C

D. An exception is thrown.

B. The first if statement is false because the variables do not point to the same object.The second if statement is true because ArrayList implements equality to mean the same elements in the same order.

What is the output of the following code?

LocalDate date = LocalDate.of(2018, Month.APRIL, 30);

date.plusDays(2);

date.plusYears(3);

System.out.println(date.getYear() + " " + date.getMonth() + " "

+ date.getDayOfMonth());

A. 2018 APRIL 2

B. 2018 APRIL 30

C. 2018 MAY 2

D. 2021 APRIL 2

E. 2021 APRIL 30

B. The date starts out as April 30, 2018. Since Dates are immutable and the plus methods have their return values ignored, the result is unchanged. Therefore, option B is correct.

33. What is the output of the following code?

LocalDateTime d = LocalDateTime.of(2015, 5, 10, 11, 22, 33);

Period p = Period.ofDays(1).ofYears(2);

d = d.minus(p);

DateTimeFormatter f = DateTimeFormatter.ofLocalizedDateTime(FormatStyle

.SHORT);

System.out.println(f.format(d));

A. 5/9/13 11:22 AM

B. 5/10/13 11:22 AM

C. 5/9/14

D. 5/10/14

E. The code does not compile.

F. A runtime exception is thrown.

B. Period does not allow chaining. Only the last Period method called counts, so only the two years are subtracted.

## 4.Methods-Constructors-Lambdas

public final void nap(int minutes) throws InterruptedException {

// take a nap

}

default void walk2() {} // DOES NOT COMPILE

walk2() doesn’t compile because default is not a valid access modifier.

public final void walk2() {}

public static final void walk3() {}

public final static void walk4() {}

public modifier void walk5() {} // DOES NOT COMPILE

public void final walk6() {} // DOES NOT COMPIL

final public void walk7() {}

walk3() and walk4() are valid method declarations with both final and static as optional specifiers. The order of these two keywords doesn’t matter. walk7() does compile. Java allows the optional specifi ers to appear before the accessmodifier

Finally Order will be

**{Access Specifier/ Optional Specifier /or both} returntype methodname{ }**

**Static Block**

static blocks will execute at the time of class loading only.

1.Identification of static members from parent to child

2.Execution of static variable assignments and static blocks from parent to child.

3.Execution of child class main method.

**Instance blocks**

1.Identification of Instance members from parent to child

**Parent Class:**

2.Execution of Instance variable assignments and instance blocks only in parent class

3.Execution of Parent class constructor.

**Child Class:**

4.Execution of Instance variable assignments and instance blocks in the child class.

5.Execution of child class constructor

Static Blocks will execute at Class loading time, in both parent child classes,

Finally Order is :Static Block > Instance Block > Constructor

class A {

A() {

System.out.println("Class-A : Costrcutor");

}

static {

System.out.println("Class-A : Static Block");

}

{

System.out.println("Class-A : Instance Block");

}

}

public class Order extends A {

Order() {

System.out.println("Order : Costrcutor");

}

static {

System.out.println("Order : Static Block");

}

{

System.out.println("Order : Instance Block");

}

public static void main(String[] args) {

A ob = new A(); // only A Class

System.out.println("A==Completed");

Order o1 = new Order(); // Order class Contains A Class DataMembers

System.out.println("Order1 == Completed");

Order o2 = new Order(); // Order class Contains A Class DataMembers

System.out.println("Order2 == Completed");

}

}

Class-A : Static Block

Order : Static Block

Class-A : Instance Block

Class-A : Costrcutor

A==Completed

Class-A : Instance Block

Class-A : Costrcutor

Order : Instance Block

Order : Costrcutor

Order1 == Completed

Class-A : Instance Block

Class-A : Costrcutor

Order : Instance Block

Order : Costrcutor

Order2 == Completed

**Lambdas**

Lambdas work with interfaces that have only one method. These are called functional interfaces—interfaces that can be used with functional programming.

print(animals, a -> a.canSwim());

How about Animals that cannot swim?

print(animals, a -> ! a.canSwim());

The syntax of lambdas is tricky because many parts are optional. These two lines do the exact same thing:

a -> a.canHop()

(Animal a) -> { return a.canHop(); }

valid interfaces that can consume a lambda with zero, one, or two String parameters.

3: print(() -> true); // 0 parameters

4: print(a -> a.startsWith("test")); // 1 parameter

5: print((String a) -> a.startsWith("test")); // 1 parameter

6: print((a, b) -> a.startsWith("test")); // 2 parameters

7: print((String a, String b) -> a.startsWith("test")); // 2 parameters

print(a, b -> a.startsWith("test")); // DOES NOT COMPILE

print(a -> { a.startsWith("test"); }); // DOES NOT COMPILE

print(a -> { return a.startsWith("test") }); // DOES NOT COMPILE

The first line needs parentheses around the parameter list. Remember that the parentheses are only optional when there is one parameter and it doesn’t have a type declared. The second line is missing the return keyword. The last line is missing the semicolon.

You might have noticed all of our lambdas return a boolean. That is because the scope for the OCA exam limits what you need to learn.

(a, b) -> { int a = 0; return 5;} // DOES NOT COMPILE (right side arg a,b so a redeclared)

We tried to redeclare a, which is not allowed. By contrast, the following line is okay because it uses a different variable name:

(a, b) -> { int c = 0; return 5;}

**Predicates**

In our earlier example, we created an interface with one method:

boolean test(Animal a);

You can imagine that we’d have to create lots of interfaces like this to use lambdas. We want to test Animals and Strings and Plants and anything else that we come across. Luckily, Java recognizes that this is a common problem and provides such an interface

for us. It’s in the package java.util.function and the gist of it is as follows:

public interface Predicate<T> {

boolean test(T t);

}

The only difference is that it uses this type T instead of Animal. That’s the syntax for generics. It’s like when we created an ArrayList and got to specify any type that goes in it.

Java 8 even integrated the Predicate interface into some existing classes. There is only one you need to know for the exam. ArrayList declares a removeIf() method that takes a Predicate.

3: List<String> bunnies = new ArrayList<>();

4: bunnies.add("long ear");

5: bunnies.add("floppy");

6: bunnies.add("hoppy");

7: System.out.println(bunnies); // [long ear, floppy, hoppy]

8: bunnies.removeIf(s -> s.charAt(0) != 'h');

9: System.out.println(bunnies); // [hoppy]

Line 8 takes care of everything for us. It defi nes a predicate that takes a String and returns a boolean. The removeIf() method does the rest.For the OCA exam, you only need to know how to implement lambda expressions thatuse the Predicate interface. Remember the one method in the interface called test()?

Questions

**\*\*\*\* moreB(int values[], int... nums) -> No Compile time error or Runtime Error**

**case 1 : moreB(new int[]{1,2,3,4,5} ); //takes as int values[], nums will empty**

**case 2 : moreB(new int[]{1,2,3,4,5}, new int[]{6,7,8,9,10} );//2 seperate arrays , one for values[], one for nums..**

25.Which of the following are true about the following code? (Choose all that apply)

public class Create {

Create() {

System.out.print("1 ");

}

Create(int num) {

System.out.print("2 ");

}

Create(Integer num) {

System.out.print("3 ");

}

Create(Object num) {

System.out.print("4 ");

}

Create(int... nums) {

System.out.print("5 ");

}

public static void main(String[] args) {

new Create(100);

new Create(1000L);

}

}

A. The code prints out 2 4.

B. The code prints out 3 4.

C. The code prints out 4 2.

D. The code prints out 4 4.

E. The code prints 3 4 if you remove the constructor Create(int num).

F. The code prints 4 4 if you remove the constructor Create(int num).

G. The code prints 5 4 if you remove the constructor Create(int num).

1. Which of the following can fill in the blank in this code to make it compile?

public class Ant {

\_\_\_\_\_ void method() { }

}

A. default

B. final

C. private

D. Public

E. String

F. zzz:

B, C. void is a return type. Only the access modifier or optional specifiers are allowed before the return type. Option C is correct, creating a method with private access. Option B is correct, creating a method with default access and the optional specifier

final.F is incorrect because labels are not allowed for methods

5. Given the following method, which of the method calls return 2? (Choose all that apply)

public int howMany(boolean b, boolean... b2) {

return b2.length;

}

A. howMany();

B. howMany(true);

C. howMany(true, true);

D. howMany(true, true, true);

E. howMany(true, {true});

F. howMany(true, {true, true});

G. howMany(true, new boolean[2]);

D, G. Option D passes the initial parameter plus two more to turn into a vararg array of size 2. Option G passes the initial parameter plus an array of size 2. Option A does not compile because it does not pass the initial parameter. Options E and F do not compile because they do not declare an array properly. It should be new boolean[] {true}. Option B creates a vararg array of size 0 and option C creates a vararg array of size 1.

**8. Which of the following are true? (Choose all that apply**)

A. Encapsulation uses package private instance variables.

B. Encapsulation uses private instance variables.

C. Encapsulation allows setters.

D. Immutability uses package private instance variables.

E. Immutability uses private instance variables.

F. Immutability allows setters.

B, C, E. Encapsulation requires using methods to get and set instance variables so other classes are not directly using them. Instance variables must be private for this to work. Immutability takes this a step further, allowing only getters, so the instance variables do not change state.

10. What is the output of the following code?

1: package rope;

2: public class Rope {

3: public static int LENGTH = 5;

4: static {

5: LENGTH = 10;

6: }

7: public static void swing() {

8: System.out.print("swing ");

9: }

10: }

1: import rope.\*;

2: import static rope.Rope.\*;

3: public class Chimp {

4: public static void main(String[] args) {

5: Rope.swing();

6: new Rope().swing();

7: System.out.println(LENGTH);

8: }

9: }

A. swing swing 5

B. swing swing 10

C. Compiler error on line 2 of Chimp.

D. Compiler error on line 5 of Chimp.

E. Compiler error on line 6 of Chimp.

F. Compiler error on line 7 of Chimp.

B. Rope runs line 3, setting LENGTH to 5, then immediately after runs the static initializer,which sets it to 10. Line 5 calls the static method normally and prints swing.Line 6 also calls the static method. Java allows calling a static method through an instance variable. Line 7 uses the static import on line 2 to reference LENGTH.

11. Which are true of the following code? (Choose all that apply)

1: public class Rope {

2: public static void swing() {

3: System.out.print("swing ");

4: }

5: public void climb() {

6: System.out.println("climb ");

7: }

8: public static void play() {

9: swing();

10: climb();

11: }

12: public static void main(String[] args) {

13: Rope rope = new Rope();

14: rope.play();

15: Rope rope2 = null;

16: rope2.play();

17: }

18: }

A. The code compiles as is.

B. There is exactly one compiler error in the code.

C. There are exactly two compiler errors in the code.

D. If the lines with compiler errors are removed, the output is climb climb.

E. If the lines with compiler errors are removed, the output is swing swing.

F. If the lines with compile errors are removed, the code throws a NullPointerException.

11. B, E. Line 10 does not compile because static methods are not allowed to call instance

methods. Even though we are calling play() as if it were an instance method and an instance exists, Java knows play() is really a static method and treats it as such. If line 10 is removed, the code works. It does not throw a NullPointerException on line 16

because play() is a static method. Java looks at the type of the reference for rope2 and translates the call to Rope.play().

12. What is the output of the following code?

import rope.\*;

import static rope.Rope.\*;

public class RopeSwing {

private static Rope rope1 = new Rope();

private static Rope rope2 = new Rope();

{

System.out.println(rope1.length);

}

public static void main(String[] args) {

rope1.length = 2;

rope2.length = 8;

System.out.println(rope1.length);

}

}

package rope;

public class Rope {

public static int length = 0;

}

A. 02

B. 08

C. 2

D. 8

E. The code does not compile.

F. An exception is thrown.

D. There are two details to notice in this code. First, note that RopeSwing has an instance initializer and not a static initializer. Since RopeSwing is never constructed, the instance initializer does not run. The other detail is that length is static. Changes

from one object update this common static variable.

14. Which of the following can replace line 2 to make this code compile? (Chooseall that apply)

1: import java.util.\*;

2: // INSERT CODE HERE

3: public class Imports {

4: public void method(ArrayList<String> list) {

5: sort(list);

6: }

7: }

A. import static java.util.Collections;

B. import static java.util.Collections.\*;

C. import static java.util.Collections.sort(ArrayList<String>);

D. static import java.util.Collections;

E. static import java.util.Collections.\*;

F. static import java.util.Collections.sort(ArrayList<String>);

B. The two valid ways to do this are import static java.util.Collections.\*; and import static java.util.Collections.sort;. Option A is incorrect because you can only do a static import on static members. Classes such as Collections require a regular import. Option C is nonsense as method parameters have no business in an import. Options D, E, and F try to trick you into reversing the syntax of import static.

20. Which code can be inserted to have the code print 2?

public class BirdSeed {

private int numberBags;

boolean call;

public BirdSeed() {

// LINE 1

call = false;

// LINE 2

}

public BirdSeed(int numberBags) {

this.numberBags = numberBags;

}

public static void main(String[] args) {

BirdSeed seed = new BirdSeed();

System.out.println(seed.numberBags);

} }

A. Replace line 1 with BirdSeed(2);

B. Replace line 2 with BirdSeed(2);

C. Replace line 1 with new BirdSeed(2);

D. Replace line 2 with new BirdSeed(2);

E. Replace line 1 with this(2);

F. Replace line 2 with this(2);

E. Options A and B will not compile because constructors cannot be called without new. Options C and D will compile but will create a new object rather than setting the fields in this one. Option F will not compile because this() must be the first line of a constructor. Option E is correct.

22. What is the result of the following?

1: public class Order {

2: static String result = "";

3: { result += "c"; }

4: static

5: { result += "u"; }

6: { result += "r"; }

7: }

1: public class OrderDriver {

2: public static void main(String[] args) {

3: System.out.print(Order.result + " ");

4: System.out.print(Order.result + " ");

5: new Order();

6: new Order();

7: System.out.print(Order.result + " ");

8: }

9: }

A. curur

B. ucrcr

C. u ucrcr

D. u u curcur

E. u u ucrcr

F. ur ur urc

G. The code does not compile.

E. On line 3 of OrderDriver, we refer to Order for the first time. At this point the statics in Order get initialized. In this case, the statics are the static declaration of result and the static initializer. result is u at this point. On line 4, result is the same because the static initialization is only run once. On line 5, we create a new Order, which triggers the instance initializers in the order they appear in the file. Now result is ucr. Line 6 creates another Order, triggering another set of initializers. Now result is ucrcr. Notice how the static is on a different line than the initialization code in lines 4–5 of Order.

27. What is the result of the following code?

1: interface Climb {

2: boolean isTooHigh(int height, int limit);

3: }

4:

5: public class Climber {

6: public static void main(String[] args) {

7: check((h, l) -> h.append(l).isEmpty(), 5);

8: }

9: private static void check(Climb climb, int height) {

10: if (climb.isTooHigh(height, 10))

11: System.out.println("too high");

12: else

13: System.out.println("ok");

14: }

15: }

A. ok

B. too high

C. Compiler error on line 7.

D. Compiler error on line 10.

E. Compiler error on a different line.

F. A runtime exception is thrown.

C. The interface takes two int parameters. The code on line 7 attempts to use them as if one is a StringBuilder. It is tricky to use types in a lambda when they are implicitly specified. Remember to check the interface for the real type.

28. Which of the following lambda expressions can fill in the blank? (Choose all that apply)

List<String> list = new ArrayList<>();

list.removeIf(\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_);

Review Questions 231

A. s -> s.isEmpty()

B. s -> {s.isEmpty()}

C. s -> {s.isEmpty();}

D. s -> {return s.isEmpty();}

E. String s -> s.isEmpty()

F. (String s) -> s.isEmpty()

A, D, F. removeIf() expects a Predicate, which takes a parameter list of one parameter using the specified type. Options B and C are incorrect because they do not use the return keyword. It is required inside braces for lambda bodies. Option E is incorrect

because it is missing the parentheses around the parameter list. This is only optional for a single parameter with an inferred type.

29. Which lambda can replace the MySecret class to return the same value? (Chooseall that apply)

interface Secret {

String magic(double d);

}

class MySecret implements Secret {

public String magic(double d) {

return "Poof";

}

}

A. caller((e) -> "Poof");

B. caller((e) -> {"Poof"});

C. caller((e) -> { String e = ""; "Poof" });

D. caller((e) -> { String e = ""; return "Poof"; });

E. caller((e) -> { String e = ""; return "Poof" });

F. caller((e) -> { String f = ""; return "Poof"; });

A, F. Option B is incorrect because it does not use the return keyword. Options C, D,and E are incorrect because the variable e is already in use from the lambda and cannotbe redefined. Additionally, option C is missing the return keyword and option E is missing the semicolon.

## 5.Class Design-Inheritance-Super-this-abstract

public class Donkey {

}

public class Donkey {

public Donkey() {

}

}

public class Donkey {

public Donkey() {

super();

}

}

Make sure you understand the differences between these three Donkey class definitions and why Java will automatically convert them all to the last defi nition.

public class Mammal {

public Mammal(int age) {

}

}

public class Elephant extends Mammal { // DOES NOT COMPILE

}

In this example no constructor is defi ned within the Elephant class, so the compiler tries to insert a default no-argument constructor with a super() call, as it did in the Donkey example. The compiler stops, though, when it realizes there is no parent constructor that

takes no arguments.

public class Mammal {

public Mammal(int age) {

}

}

public class Elephant extends Mammal {

public Elephant() { // DOES NOT COMPILE

}

}

This code still doesn’t compile, though, because the compiler tries to insert the noargument super() as the fi rst statement of the constructor in the Elephant class, and there is no such constructor in the parent class.

public class Mammal {

public Mammal(int age) {

}

}

public class Elephant extends Mammal {

public Elephant() {

super(10);

}

}

This code will compile because we have added a constructor with an explicit call to a parent constructor. Note that the class Elephant now has a no-argument constructor even though its parent class Mammal doesn’t

4. If the parent doesn’t have a no-argument constructor and the child doesn’t define any constructors, the compiler will throw an error and try to insert a default no-argument constructor into the child class.

5. If the parent doesn’t have a no-argument constructor, the compiler requires an explicit call to a parent constructor in each child constructor

class Primate {

public Primate() {

System.out.println("Primate");

}

}

class Ape extends Primate {

public Ape() {

System.out.println("Ape");

}

}

public class Chimpanzee extends Ape {

public static void main(String[] args) {

new Chimpanzee();

}

}

The compiler fi rst inserts the super() command as the fi rst statement of both the Primate and Ape constructors. Next, the compiler inserts a default no-argument constructor in the Chimpanzee class with super() as the fi rst statement of the constructor. The code

will execute with the parent constructors called fi rst and yields the following output:

Primate

Ape

public class Canine {

public double getAverageWeight() {

return 50;

}

}

public class Wolf extends Canine {

public double getAverageWeight() {

return super.getAverageWeight()+20;

}

public static void main(String[] args) {

System.out.println(new Canine().getAverageWeight());

System.out.println(new Wolf().getAverageWeight());

}

}

In this example, in which the child class Wolf overrides the parent class Canine, the method getAverageWeight() runs without issue and outputs the following:

50.00

70.00

You might be wondering, was the use of super in the child’s method required? For example, what would the following code output if we removed the super keyword in the getAverageWeight() method of the Wolf class?

public double getAverageWeight() {

return getAverageWeight()+20; // INFINITE LOOP

The compiler performs the following checks when you override a nonprivate method:

1. The method in the child class must have the same signature as the method in the parent class

2. The method in the child class must be at least as accessible or more accessible than the method in the parent class.

3. The method in the child class may not throw a New Exception or Larger Exception their parent class method.

4. If the method returns a value, it must be the same or a subclass of the method in parent class, known as covariant return types.

5. The method defined in the child class must be marked as static if it is marked as static in the parent class (method hiding). Likewise, the method must not be marked as static in the child class if it is not marked as static in the parent class (method

overriding).

**Case1 :**

public class InsufficientDataException extends Exception {}

public class Reptile {

protected boolean hasLegs() throws InsufficientDataException {

throw new InsufficientDataException();

}

protected double getWeight() throws Exception {

return 2;

}

}

public class Snake extends Reptile {

protected boolean hasLegs() { //No Issue

return false;

}

protected double getWeight() throws InsufficientDataException{//No Issue

return 2;

}

}

**Case:2**

public class InsufficientDataException extends Exception {}

public class Reptile {

protected double getHeight() throws InsufficientDataException {

return 2;

}

protected int getLength() {

return 10;

}

}

public class Snake extends Reptile {

protected double getHeight() throws Exception { // DOES NOT COMPILE

return 2;

}

protected int getLength() throws InsufficientDataException { // DOES NOT COMPILE

return 10;

}

}

The getHeight() method in the parent class throws an InsufficientDataException,whereas the method in the child class throws an Exception. Since Exception is not a subclass of InsufficientDataException, the third rule of overriding methods is

violated and the code will not compile. Coincidentally, Exception is a superclass of InsufficientDataException.

Next, the getLength() method doesn’t throw an exception in the parent class, but it does throw an exception, insufficientDataException, in the child class. In this manner,the child class defi nes a new exception

**Redeclaring private Methods**

In Java, it is not possible to override a private method in a parent class since the parent method is not accessible from

the child class.Java permits you to redeclare a new method in the child class with the same or modified signature as the method in the parent class. This method in the child class is a separate and independent method, unrelated to the parent version’s method

public class Camel {

private String getNumberOfHumps() {

return "Undefined";

}

}

public class BactrianCamel extends Camel {

private int getNumberOfHumps() {

return 2;

}

}

This code compiles without issue.

**Overriding vs. Hiding Methods**

At runtime the child version of an overridden method is always executed for an instance regardless of whether the method call is defined in a parent or child class method. In this manner, the parent method is never used unless an explicit call to the parent method is referenced, using the syntax ParentClassName.method().

Alternatively, at runtime the parent version of a hidden method is always executed if the call to the method is defi ned in the

parent class.

public class Marsupial {

public static boolean isBiped() {

return false;

}

public void getMarsupialDescription() {

System.out.println("Marsupial walks on two legs: "+isBiped());

}

}

public class Kangaroo extends Marsupial {

public static boolean isBiped() {

return true;

}

public void getKangarooDescription() {

System.out.println("Kangaroo hops on two legs: "+isBiped());

}

public static void main(String[] args) {

Kangaroo joey = new Kangaroo();

joey.getMarsupialDescription();

joey.getKangarooDescription();

}

}

In this example, the code compiles and runs without issue, outputting the following:

Marsupial walks on two legs: false

Kangaroo hops on two legs: true

Notice that isBiped() returns false in the parent class and true in the child class.In the fi rst method call, the parent method getMarsupialDescription() is used. TheMarsupial class only knows about isBiped() from its own class defi nition, so it outputs

false. In the second method call, the child executes a method of isBiped(), which hides the parent method’s version and returns true.

Contrast this fi rst example with the following example, which uses an overridden version of isBiped() instead of a hidden version:

class Marsupial {

public boolean isBiped() {

return false;

}

public void getMarsupialDescription() {

System.out.println("Marsupial walks on two legs: "+isBiped());

}

}

public class Kangaroo extends Marsupial {

public boolean isBiped() {

return true;

}

public void getKangarooDescription() {

System.out.println("Kangaroo hops on two legs: "+isBiped());

}

public static void main(String[] args) {

Kangaroo joey = new Kangaroo();

joey.getMarsupialDescription();

joey.getKangarooDescription();

}

}

This code also compiles and runs without issue, but it outputs slightly different text:

Marsupial walks on two legs: true

Kangaroo hops on two legs: true

In this example, the isBiped() method is overridden, not hidden, in the child class.Therefore, it is replaced at runtime in the parent class with the call to the child class’s method.Make sure you understand these examples as they show how hidden and overridden

methods are fundamentally different.

**Abstract Classes**

public [abstract/final] class ElephantSeal extends Seal {

// Methods and Variables defined here

}

public abstract class Turtle {

public abstract void swim() {} // DOES NOT COMPILE

public abstract int getAge() { // DOES NOT COMPILE

return 10;

}

}

The first method, swim(), doesn’t compile because two brackets are provided instead of a semicolon, and Java interprets this as providing a body to an abstract method. The second method, getAge(), doesn’t compile because it also provides a body to an abstract method.

abstract class and abstract methods cannot be marked as final A method may not be marked as both abstract and private.

Even with abstract methods, the 5 rules for overriding methods must be followed.

public abstract class Whale {

protected abstract void sing();

}

public class HumpbackWhale extends Whale {

private void sing() { // DOES NOT COMPILE

System.out.println("Humpback whale is singing");

}

}

overriding a method, the subclass cannot reduce the visibility of the parent method, sing().

public abstract class Animal {

public abstract String getName();

}

public class Walrus extends Animal { // DOES NOT COMPILE

}

public abstract class Eagle extends Animal {

}

In this example, we again have an abstract class Animal with a concrete subclass Walrus that doesn’t compile since it doesn’t implement a getName() method. We also have an abstract class Eagle, which like Walrus extends Animal and doesn’t provide an implementation for getName(). In this situation, Eagle does compile because it is marked as abstract

**Interfaces**

public interface CanBurrow {

public static final int MINIMUM\_DEPTH = 2;

public abstract int getMaximumDepth();

}

A class may implement multiple interfaces, each separated by a comma, such as in the following example:

public class Elephant implements WalksOnFourLegs, HasTrunk, Herbivore {

}

**Defining an Interface**

-

1. Interfaces cannot be instantiated directly.

2. An interface is not required to have any methods.

3. An interface may not be marked as final.

4. All top-level interfaces are assumed to have public or default access, and they must include the abstract modifier in their definition. Therefore, marking an interface as private, protected, or final will trigger a compiler error, since this is incompatible

with these assumptions.

5. All nondefault methods in an interface are assumed to have the modifiers abstract and public in their definition. Therefore, marking a method as private, protected, or final will trigger compiler errors as these are incompatible with the abstract and

public keywords.

The fourth rule doesn’t apply to inner interfaces, although inner classes and interfacesare not in scope for the OCA exam.

For example, the following two interface definitions are equivalent, as the compiler will convert them both to the second example:

public interface CanFly {

void fly(int speed);

abstract void takeoff();

public abstract double dive();

}

public abstract interface CanFly {

public abstract void fly(int speed);

public abstract void takeoff();

public abstract double dive();

}

Let’s take a look at an example that violates the assumed keywords:

private final interface CanCrawl { // DOES NOT COMPILE

private void dig(int depth); // DOES NOT COMPILE

protected abstract double depth(); // DOES NOT COMPILE

public final void surface(); // DOES NOT COMPILE

}

Every single line of this example doesn’t compile. The first line doesn’t compile for two reasons. First, it is marked as final, which cannot be applied to an interface since it conflicts with the assumed abstract keyword. Next, it is marked as private, which confl icts

with the public or default required access for interfaces.

what will happen if you define a class that inherits from two interfaces that contain the same

abstract method?

public interface Herbivore {

public void eatPlants();

}

public interface Omnivore {

public void eatPlants();

public void eatMeat();

}

In this scenario, the signatures for the two interface methods eatPlants() are compatible,so you can define a class that fulfi lls both interfaces simultaneously:

public class Bear implements Herbivore, Omnivore {

public void eatMeat() {

System.out.println("Eating meat");

}

public void eatPlants() {

System.out.println("Eating plants");

}

}

Why does this work? Remember that interface methods in this example are abstract and define the “behavior” that the class implementing the interface must have. If two abstract interface methods have identical behaviors—or in this case the same method

signature— creating a class that implements one of the two methods automatically implements the second method. In this manner, the interface methods are considered duplicates since they have the same signature

What happens if the two methods have different signatures? If the method name is the same but the input parameters are different, there is no conflict because this is considered a method overload. We demonstrate this principle in the following example:

public interface Herbivore {

public int eatPlants(int quantity);

}

public interface Omnivore {

public void eatPlants();

}

public class Bear implements Herbivore, Omnivore {

public int eatPlants(int quantity) {

System.out.println("Eating plants: "+quantity);

return quantity;

}

public void eatPlants() {

System.out.println("Eating plants");

}

}

In this example, we see that the class that implements both interfaces must provide implements of both versions of eatPlants(), since they are considered separate methods.Notice that it doesn’t matter if the return type of the two methods is the same or different,

because the compiler treats these methods as independent.

Unfortunately, if the method name and input parameters are the same but the return types are different between the two methods, the class or interface attempting to inherit both interfaces will not compile. The reason the code doesn’t compile has less to do with

interfaces and more to do with class design, as discussed in Chapter 4. It is not possible in Java to define two methods in a class with the same name and input parameters but different return types.

Given the following two interface definitions for Herbivore and Omnivore,the following code will not compile:

public interface Herbivore {

public int eatPlants();

}

public interface Omnivore {

public void eatPlants();

}

public class Bear implements Herbivore, Omnivore {

public int eatPlants() { // DOES NOT COMPILE

System.out.println("Eating plants: 10");

return 10;

}

public void eatPlants() { // DOES NOT COMPILE

System.out.println("Eating plants");

}

}

public interface Herbivore {

public int eatPlants();

}

public interface Omnivore {

public void eatPlants();

}

public interface Supervore extends Herbivore, Omnivore {} // DOES NOT COMPILE

public abstract class AbstractBear implements Herbivore, Omnivore {}

// DOES NOT COMPILE

Even without implementation details, the compiler detects the problem with the abstract definition and prevents compilation

**Interface Variables**

1. Interface variables are assumed to be public, static, and final. Therefore, marking a variable as private or protected will trigger a compiler error, as will marking any variable as abstract.

2. The value of an interface variable must be set when it is declared since it is marked as final.

Based on these rules, it should come as no surprise that the following entries will not compile:

public interface CanDig {

private int MAXIMUM\_DEPTH = 100; // DOES NOT COMPILE

protected abstract boolean UNDERWATER = false; // DOES NOT COMPILE

public static String TYPE; // DOES NOT COMPILE

}

**Default Interface Methods**

Java 8, the authors of Java have introduced a new type of method to an interface, referred to as a default method. A default method is a method defined within an interface with the default keyword in which a method body is provided.In this manner, classes have the option to override the default method if they need to, but they are not required to do so. If the class doesn’t override the method, the default implementation will be used. In this manner, the method definition is concrete, not abstract.

1. A default method may only be declared within an interface and not within a class or abstract class.

2. A default method must be marked with the default keyword. If a method is marked as default, it must provide a method body.

3. A default method is not be static, final, or abstract, as it may be used or overridden by a class that implements the interface.

4. Like all methods in an interface, a default method is assumed to be public and will not compile if marked as private or protected.

The following is an example of a default method defined in an interface:

public interface IsWarmBlooded {

boolean hasScales();

public default double getTemperature() {

return 10.0;

}

}

This example defines two interface methods, one is a normal abstract method and the other a default method. Note that both methods are assumed to be public, as all methods of an interface are all public. The first method is terminated with a semicolon and doesn’t provide a body, whereas the second default method provides a body. Any class that implements IsWarmBlooded may rely on the default implementation of getTemperature() or override the method and create its own version.

public interface Carnivore {

public default void eatMeat(); // DOES NOT COMPILE

public int getRequiredFoodAmount() { // DOES NOT COMPILE

return 13;

}

}

eatMeat(), doesn’t compile because it is marked as default but doesn’t provide a method body. The second method, getRequiredFood Amount(), also doesn’t compile because it provides a method body but is not marked with

the default keyword.

When an interface extends another interface that contains a default method, it may choose to ignore the default method, in which case the default implementation for the method will be used. Alternatively, the interface may override the definition of the default

method using the standard rules for method overriding, such as not limiting the accessibility of the method and using covariant returns.

public interface HasFins {

public default int getNumberOfFins() {

return 4;

}

public default double getLongestFinLength() {

return 20.0;

}

public default boolean doFinsHaveScales() {

return true;

}

}

public interface SharkFamily extends HasFins {

public default int getNumberOfFins() {

return 8;

}

public double getLongestFinLength();

public boolean doFinsHaveScales() { // DOES NOT COMPILE

return false;

}

}

SharkFamily, extends HasFins and overrides the default method getNumberOfFins() with a new method that returns a different value. Next, the SharkFamily interface replaces the default method getLongestFinLength() with a new abstract method, forcing any class that implements the SharkFamily interface to provide an implementation of the method. Finally, the SharkFamily interface overrides the doFinsHaveScales() method but doesn’t mark the method as default.

**Default Methods and Multiple Inheritance**

public interface Walk {

public default int getSpeed() {

return 5;

}

}

public interface Run {

public default int getSpeed() {

return 10;

}

}

public class Cat implements Walk, Run { // DOES NOT COMPILE

public static void main(String[] args) {

System.out.println(new Cat().getSpeed());

}

}

If a class implements two interfaces that have default methods with the same name and signature, the compiler will throw an error. There is an exception to this rule, though: if the subclass overrides the duplicate default methods, the code will compile without

issue—the ambiguity about which version of the method to call has been removed. For example, the following modified implementation of Cat will compile and output 1:

public class Cat implements Walk, Run {

public int getSpeed() {

return 1;

}

**Static Interface Methods**

Java 8 also now includes support for static methods within interface.A static method defined in an interface is not inherited in any classes that implement the interface.

Here are the static interface method rules you need to be familiar with:

1. Like all methods in an interface, a static method is assumed to be public and will not compile if marked as private or protected.

2. To reference the static method, a reference to the name of the interface must be used.

public interface Hop {

static int getJumpHeight() {

return 8;

}

}

public class Bunny implements Hop {

public void printDetails() {

System.out.println(Hop.getJumpHeight());

System.out.println(getJumpHeight()); // DOES NOT COMPILE

}

}

It follows, then, that a class that implements two interfaces containing static methods with the same signature will still compile at runtime, because the static methods are not inherited by the subclass and must be accessed with a reference to the interface name.

Contrast this with the behavior you saw for default interface methods in the previous section: the code would compile if the subclass overrode the default methods and would fail to compile.

**Polymorphisum**

Casting variables:

1. Casting an object from a subclass to a superclass doesn’t require an explicit cast.

2. Casting an object from a superclass to a subclass requires an explicit cast.

3. The compiler will not allow casts to unrelated types.

4. Even when the code compiles without issue, an exception may be thrown at runtime if the object being cast is not actually an instance of that class

public class Bird {}

public class Fish {

public static void main(String[] args) {

Fish fish = new Fish();

Bird bird = (Bird)fish; // DOES NOT COMPILE

}

}

In this example, the classes Fish and Bird are not related through any class hierarchy that the compiler is aware of; therefore, the code will not compile.

public class Rodent {

}

public class Capybara extends Rodent {

public static void main(String[] args) {

Rodent rodent = new Rodent();

Capybara capybara = (Capybara)rodent; // Throws ClassCastException at runtime

}

}

This code creates an instance of Rodent and then tries to cast it to a subclass of Rodent, Capybara. Although this code will compile without issue, it will throw a ClassCastException at runtime since the object being referenced is not an instance of the Capybara class. The thing to keep in mind in this example is the object that was created is not related to the Capybara class in any way.

A virtual method is a method in which the specifi c implementation is not determined until runtime. In fact, all non-fi nal, nonstatic,

and non-private Java methods are considered virtual methods, since any of them can be overridden at runtime.

public class Bird {

public String getName() {

return "Unknown";

}

public void displayInformation() {

System.out.println("The bird name is: "+getName());

}

}

public class Peacock extends Bird {

public String getName() {

return "Peacock";

}

public static void main(String[] args) {

Bird bird = new Peacock();

bird.displayInformation();

}

}

This code compiles and executes without issue and outputs the following:

The bird name is: Peacock

Questions

1. What modifiers are implicitly applied to all interface methods? (Choose all that apply)

A. protected

B. public

C. static

D. void

E. abstract

F. default

B. All interface methods are implicitly public,Option E is a tricky one, because prior to Java 8 all interface methods would be assumed to be abstract. Since Java 8 now includes default and static methods and they are never abstract, you cannot assume the abstract modifier will be implicitly applied to all methods by the compiler

5. Which of the following may only be hidden and not overridden? (Choose all that apply)

A. private instance methods

B. protected instance methods

C. public instance methods

D. static methods

E. public variables

F. private variables

A, D, E, F. First off, options B and C are incorrect because protected and public methods may be overridden, not hidden. Option A is correct because private methods are always hidden in a subclass. Option D is also correct because static methods cannot be overridden, only hidden. Options E and F are correct because variables may only be hidden, regardless of the access modifier

7. Which of the following statements about polymorphism are true? (Choose all that apply)

A. A reference to an object may be cast to a subclass of the object without an explicit cast.

B. If a method takes a superclass of three objects, then any of those classes may be passed as a parameter to the method.

C. A method that takes a parameter with type java.lang.Object will take any reference.

D. All cast exceptions can be detected at compile-time.

E. By defining a public instance method in the superclass,guarantee the specific method will be called in the parent class at runtime

B, C. A reference to an object requires an explicit cast if referenced with a subclass, so option A is incorrect. If the cast is to a superclass reference, then an explicit cast is not required. Because of polymorphic parameters, if a method takes the superclass of

an object as a parameter, then any subclass references may be used without a cast, so option B is correct. All objects extend java.lang.Object, so if a method takes that type, any valid object, including null, may be passed; therefore, option C is correct.

Some cast exceptions can be detected as errors at compile-time, but others can only be detected at runtime, so D is incorrect. Due to the nature of polymorphism, a public instance method can be overridden in a subclass and calls to it will be replaced even in

the superclass it was defined, so E is incorrect

10. Which statements are true for both abstract classes and interfaces? (Choose all that apply)

A. All methods within them are assumed to be abstract.

B. Both can contain public static final variables.

C. Both can be extended using the extend keyword.

D. Both can contain default methods.

E. Both can contain static methods.

F. Neither can be instantiated directly.

G. Both inherit java.lang.Object.

B, C, E, F. Option A is wrong, because an abstract class may contain concrete methods.Since Java 8, interfaces may also contain concrete methods in form of static ordefault methods. Although all variables in interfaces are assumed to be public staticfinal, abstract classes may contain them as well, so option B is correct. Both abstractclasses and interfaces can be extended with the extends keyword, so option C is correct.Only interfaces can contain default methods, so option D is incorrect. Bothabstract classes and interfaces can contain static methods, so option E is correct. Bothstructures require a concrete subclass to be instantiated, so option F is correct. Finally,though an instance of an object that implements an interface inherits java.lang.Object, the interface itself doesn't; otherwise, Java would support multiple inheritancefor objects, which it doesn't. Therefore, option G is incorrect

12. What is the output of the following code?

1: interface Nocturnal {

2: default boolean isBlind() { return true; }

3: }

4: public class Owl implements Nocturnal {

5: public boolean isBlind() { return false; }

6: public static void main(String[] args) {

7: Nocturnal nocturnal = (Nocturnal)new Owl();

8: System.out.println(nocturnal.isBlind());

9: }

10: }

A. true

B. false

C. The code will not compile because of line 2.

D. The code will not compile because of line 5.

E. The code will not compile because of line 7.

F. The code will not compile because of line 8.

B. This code compiles and runs without issue, outputting false, so option B is thecorrect answer. The first declaration of isBlind() is as a default interface method,assumed public. The second declaration of isBlind() correctly overrides the defaultinterface method. Finally, the newly created Owl instance may be automatically cast toa Nocturnal reference without an explicit cast, although adding it doesn’t break thecode.

16. What is the output of the following code?

1: abstract class Reptile {

2: public final void layEggs() { System.out.println("Reptile laying eggs");

}

3: public static void main(String[] args) {

4: Reptile reptile = new Lizard();

5: reptile.layEggs();

6: }

7: }

8: public class Lizard extends Reptile {

9: public void layEggs() { System.out.println("Lizard laying eggs"); }

10: }

A. Reptile laying eggs

B. Lizard laying eggs

C. The code will not compile because of line 4.

D. The code will not compile because of line 5.

E. The code will not compile because of line 9.

E. The code doesn’t compile, so options A and B are incorrect. The issue with line 9 is that layEggs() is marked as final in the superclass Reptile, which means it cannot be overridden. There are no errors on any other lines, so options C and D are incorrect

18. What is the output of the following code? (Choose all that apply)

1: interface Aquatic {

2: public default int getNumberOfGills(int input) { return 2; }

3: }

4: public class ClownFish implements Aquatic {

5: public String getNumberOfGills() { return "4"; }

6: public String getNumberOfGills(int input) { return "6"; }

7: public static void main(String[] args) {

8: System.out.println(new ClownFish().getNumberOfGills(-1));

9: }

10: }

A. 2

B. 4

C. 6

D. The code will not compile because of line 5.

E. The code will not compile because of line 6.

F. The code will not compile because of line 8.

E. The code doesn’t compile because line 6 contains an incompatible override of thegetNumberOfGills(int input) method defined in the Aquatic interface. In particular,int and String are not covariant returns types, since int is not a subclass of String.Note that line 5 compiles without issue; getNumberOfGills() is an overloaded methodthat is not related to the parent interface method that takes an int value.

19. Which of the following statements can be inserted in the blank so that the code will compile successfully? (Choose all that apply)

public class Snake {}

public class Cobra extends Snake {}

public class GardenSnake {}

public class SnakeHandler {

private Snake snake;

public void setSnake(Snake snake) { this.snake = snake; }

public static void main(String[] args) {

new SnakeHandler().setSnake( );

}

}

A. new Cobra()

B. new GardenSnake()

C. new Snake()

D. new Object()

E. new String("Snake")

F. null

A, C, F. First off, Cobra is a subclass of Snake, so option A can be used. GardenSnake isnot defined as a subclass of Snake, so it cannot be used and option B is incorrect. Theclass Snake is not marked as abstract, so it can be instantiated and passed, so optionC is correct. Next, Object is a superclass of Snake, not a subclass, so it also cannot beused and option D is incorrect. The class String is unrelated in this example, so optionE is incorrect. Finally, a null value can always be passed as an object value, regardlessof type, so option F is correct.

## 6.Exception Handling

**java.lang.Object**

**|**

**java.lang.Throwable**

/ \

**java.lang.Exception** **java.lang.Error**

|

**java.lang.RuntimeException**

A **checked exception** includes Exception and all subclasses that do not extend RuntimeException. Checked exceptions tend to be more anticipated—for example, trying to read a file that doesn’t exist.

-Java has a rule called the handle or declare rule.

-For checked exceptions, Java requires the code to either handle them or declare them in the method signature.

**Runtime exceptions** (unchecked exceptions) tend to be unexpected but not necessarily fatal.For example, accessing an invalid array index is unexpected.

Error means something went so horribly wrong that your program should not attempt to recover from it. ex, the disk drive “disappeared.”

**Runtime Exceptions**

Runtime exceptions extend RuntimeException. They don’t have to be handled or declared.They thrown by the programmer/by JVM.

-ArithmeticException: Thrown by the JVM when code attempts to divide by zero

-ArrayIndexOutOfBoundsException: Thrown by the JVM when code uses an illegal index to access an array

-ClassCastException-

-IllegalArgumentException Thrown by the programmer to indicate that a method has been passed an illegal or inappropriate argument

-NullPointerException Thrown by the JVM when there is a null reference where an object is required

-NumberFormatException Thrown by the programmer string doesn’t have an appropriate format

**Checked Exceptions**

They can be thrown by the programmer or by the JVM.Common runtime exceptions include the following:

-FileNotFoundException Thrown programmatically when code tries to reference a file that does not exist

-IOException Thrown programmatically when there’s a problem reading or writing a file

**Errors**

**Errors extend the Error class**. They are thrown by the JVM and should not be handled ordeclared. Errors are rare

-ExceptionInInitializerError Thrown by the JVM when a static initializer throws an exception and doesn’t handle it

-StackOverflowError Thrown by the JVM when a method calls itself too many times

-NoClassDefFoundError Thrown by the JVM when a class that the code uses is available at compile time but not runtime

**Calling Methods That Throw Exceptions**

class NoMoreCarrotsException extends Exception {}

public class Bunny {

public static void main(String[] args) {

eatCarrot();// DOES NOT COMPILE

}

private static void eatCarrot() throws NoMoreCarrotsException {

}

}

The problem is that NoMoreCarrotsException is a checked exception. Checked exceptions must be handled or declared. The code would compile if we changed the main() method to either of these:

public static void main(String[] args)

throws NoMoreCarrotsException {// declare exception

eatCarrot();

}

public static void main(String[] args) {

try {

eatCarrot();

} catch (NoMoreCarrotsException e ) {// handle exception

System.out.print("sad rabbit");

}

}

**Subclasses**

1.When a class overrides a method from a superclass or implements a method from an interface, it’s not allowed to add new checked exceptions to the method signature.

class Hopper {

public void hop() { }

}

class Bunny extends Hopper {

public void hop() throws CanNotHopException { } // DOES NOT COMPILE

}

2.A subclass is allowed to declare fewer exceptions than the superclass or interface. This is legal because callers are already handling them.

class Hopper {

public void hop() throws CanNotHopException { }

}

class Bunny extends Hopper {

public void hop() { } //Valid, already Handled in Super class

}

3.class is allowed to declare a subclass of an exception type. The idea is the same. The superclass or interface has already taken care of a broader type. Here’s an example:

class Hopper {

public void hop() throws Exception { }

}

class Bunny extends Hopper {

public void hop() throws CanNotHopException { }

}

-Inside catch we can throw the Exception, it will print the Stacktrace with No ISSUIE

public class Mouse {

public String name;

public void run() {

System.out.print("1");

try {

System.out.print("2");

name.toString();

System.out.print("3");

} catch (NullPointerException e) {

System.out.print("4");

throw e;

}

System.out.print("5");

}

public static void main(String[] args) {

Mouse jerry = new Mouse();

jerry.run();

System.out.print("6");

} }

Questions

5. Which of the following exceptions are thrown by the JVM? (Choose all that apply)

A. ArrayIndexOutOfBoundsException

B. ExceptionInInitializerError

C. java.io.IOException

D. NullPointerException

E. NumberFormatException

A, B, D. java.io.IOException is thrown by many methods in the java.io package,but it is always thrown programmatically. The same is true for NumberFormatException;it is thrown programmatically by the wrapper classes of java.lang. The otherthree exceptions are all thrown by the JVM when the corresponding problem arises

9. What is the output of the following program?

1: public class Laptop {

2: public void start() {

3: try {

4: System.out.print("Starting up ");

5: throw new Exception();

6: } catch (Exception e) {

7: System.out.print("Problem ");

8: System.exit(0);

9: } finally {

10: System.out.print("Shutting down ");

11: }

12: }

13: public static void main(String[] args) {

14: new Laptop().start();

15: } }

A. Starting up

B. Starting up Problem

C. Starting up Problem Shutting down

D. Starting up Shutting down

E. The code does not compile.

F. An uncaught exception is thrown

B. The main() method invokes start on a new Laptop object. Line 4 prints Starting up; then line 5 throws an Exception. Line 6 catches the exception, line 7 prints Problem, and then line 8 calls System.exit, which terminates the JVM. The finally block does not execute because the JVM is no longer running.

10. What is the output of the following program?

1: public class Dog {

2: public String name;

3: public void parseName() {

4: System.out.print("1");

5: try {

6: System.out.print("2");

7: int x = Integer.parseInt(name);

8: System.out.print("3");

9: } catch (NumberFormatException e) {

10: System.out.print("4");

11: }

12: }

13: public static void main(String[] args) {

14: Dog leroy = new Dog();

15: leroy.name = "Leroy";

16: leroy.parseName();

17: System.out.print("5");

18: } }

A. 12

B. 1234

C. 1235

D. 124

E. 1245

F. The code does not compile.

E. The parseName method is invoked within main() on a new Dog object. Line 4 prints 1. The try block executes and 2 is printed. Line 7 throws a NumberFormatException, so line 8 doesn’t execute. The exception is caught on line 9, and line 10 prints 4. Because the exception is handled, execution resumes normally. parseName runs to completion,

14. Which of the following can be inserted on line 8 to make this code compile? (Choose allthat apply)

7: public void ohNo() throws IOException {

8: // INSERT CODE HERE

9: }

A. System.out.println("it's ok");

B. throw new Exception();

C. throw new IllegalArgumentException();

D. throw new java.io.IOException();

E. throw new RuntimeException();

A, C, D, E. A method that declares an exception isn’t required to throw one, making option A correct. Runtime exceptions can be thrown in any method, making options C and E correct. Option D matches the exception type declared and so is also correct. Option B is incorrect because a broader exception is not allowed.

17. Which of the following can be inserted into Lion to make this code compile? (Choose allthat apply)

class HasSoreThroatException extends Exception {}

class TiredException extends RuntimeException {}

interface Roar {

void roar() throws HasSoreThroatException;

}

class Lion implements Roar {// INSERT CODE HERE

}

A. public void roar(){}

B. public void roar() throws Exception{}

C. public void roar() throws HasSoreThroatException{}

D. public void roar() throws IllegalArgumentException{}

E. public void roar() throws TiredException{}

A, C, D, E. The method is allowed to throw no exceptions at all, making option A correct.It is also allowed to throw runtime exceptions, making options D and E correct.Option C is also correct since it matches the signature in the interface.

18. Which of the following are true? (Choose all that apply)

A. Checked exceptions are allowed to be handled or declared.

B. Checked exceptions are required to be handled or declared.

C. Errors are allowed to be handled or declared.

D. Errors are required to be handled or declared.

E. Runtime exceptions are allowed to be handled or declared.

F. Runtime exceptions are required to be handled or declared.

A, B, C, E. Checked exceptions are required to be handled or declared. Runtime exceptions are allowed to be handled or declared. Errors are allowed to be handled or declared, but this is bad practice

20. What does the output of the following contain? (Choose all that apply)

12: public static void main(String[] args) {

13: System.out.print("a");

14: try {

15: System.out.print("b");

16: throw new IllegalArgumentException();

17: } catch (IllegalArgumentException e) {

18: System.out.print("c");

19: throw new RuntimeException("1");

20: } catch (RuntimeException e) {

21: System.out.print("d");

22: throw new RuntimeException("2");

23: } finally {

24: System.out.print("e");

25: throw new RuntimeException("3");

26: }

27: }

A. abce

B. abde

C. An exception with the message set to "1"

D. An exception with the message set to "2"

E. An exception with the message set to "3"

F. Nothing; the code does not compile.

A, E. The code begins normally and prints a on line 13, followed by b on line 15. On line 16, it throws an exception that’s caught on line 17. Remember, only the most specific matching catch is run. Line 18 prints c, and then line 19 throws another exception.Only one catch will run at a time Regardless, the finally block runs, printing e. Since the finally block also throws an exception, that’s the one printed.

# Oca warp up questions

## 1.Java Basics

22. Given the following class definition, which is the only line that does not contain a compilation error?

1: public ThisClassDoesNotCompile {

2: double int count;

3: void errors() {}

4: static void private limit; }

A. Line 1

B. Line 2

C. Line 3

D. Line 4

22. C. Line 1 is missing the class keyword. Line 2 contains two types for the same variable.Line 3 is a valid definition for a method, making C the correct answer. Finally, line 4 contains an access modifier, private, after the return type, which is not allowed. In addition,void is an invalid type for variables.

24. Which of the following is not a property of a JVM?

A. It prevents Java bytecode from being easily decoded/decompiled.

B. It supports platform independence.

C. It manages memory for the application.

D. It translates Java instructions to machine instructions.

A. Options B, C, and D are each correct statements about JVMs. Option A is incorrect.Not only is it not a statement about JVMs, it is actually false as Java bytecode can often be easily decoded/decompiled

42. is the technique of structuring programming data as a unit consisting of

attributes, with actions defined on the unit.

A. Encapsulation

B. Object orientation

C. Platform independence

D. Polymorphism

42. B. Object-oriented programming is the technique of structuring data into objects, which may contain data and a set of actions that operate on the data, making Option B the correct answer.

47. Which statements about calling the compilation command javac and the execution command

java are true?

I. java may use a period . to separate packages.

II. javac takes a .java file and returns a .class file.

III. java may use a slash (/) to separate packages.

A. I only

B. II only

C. I and II

D. I, II, and III

C. The javac command takes a text-based .java file and returns a binary bytecode.class file, making II a true statement. The java command uses a period (.) to separate packages, not a slash (/), making I a true statement and III a false statement. For these reasons, Option C is the correct answer.

50. Which statement about the JVM is true?

A. The JVM schedules garbage collection on a predictable schedule.

B. The JVM ensures that the application will always terminate.

C. The JVM requires a properly defined entry point method to execute the application.

D. A Java compiled code can be run on any computer

C. Garbage collection can happen at any time while an application is running, especially ifthe available memory suddenly becomes low, making Option A incorrect. Option B is alsoincorrect, since it is trivial to create a Java application with an infinite loop that never terminates.Option D is incorrect because the computer must be able to run the JVM in orderto execute a Java class. Option C is the only correct answer, as the JVM does require anentry point method to begin executing the application.

## 2.Data Types

12. Which of the following lists of primitive types are presented in order from smallest to largest data type?

A. byte, char, float, double

B. byte, char, double, float

C. char, byte, float, double

D. char, double, float, bigint

A. A byte is smaller than a char, making Option C incorrect. bigint is not a primitive,making Option D incorrect. A double uses twice as much memory as a float variable,therefore Option A is correct.

16. Of the types double, int, and short, how many could fill in the blank to have this code output 0?

public static void main(String[] args) {

defaultValue;

System.out.println(defaultValue);

}

A. None

B. One

C. Two

D. Three

A. Since defaultValue is a local variable, it is not automatically initialized. That means the code will not compile with any type. Therefore, Option A is correct. If this was an instance variable, Option C would be correct as int and short would be initialized to 0 while double would be initialized to 0.0.

17. What is true of the finalize() method?

A. It may be called zero or one times.

B. It may be called zero or more times.

C. It will be called exactly once.

D. It may be called one or more times.

A. The finalize() method may not be called, such as if your program crashes. However,it is guaranteed to be called no more than once.

19. Suppose you have the following code. Which of the images best represents the state of the references right before the end of the main method, assuming garbage collection hasn’t run?

1: public class Link {

2: private String name;

3: private Link next;

4: public Link(String name, Link next) {

5: this.name = name;

6: this.next = next;

7: }

8: public void setNext(Link next) {

9: this.next = next;

10: }

11: public Link getNext() {

12: return next;

13: }

14: public static void main(String... args) {

15: Link link1 = new Link("x", null);

16: Link link2 = new Link("y", link1);

17: Link link3 = new Link("z", link2);

18: link2.setNext(link3);

19: link3.setNext(link2);

20: link1 = null;

21: link3 = null;

22: }

23: }

C. Lines 15–17 create the three objects. Lines 18–19 change the references so link2 and link3 point to each other. The lines 20–21 wipe out two of the original references. This means the object with name as x is inaccessible.

21. What is the first line in the following code to not compile?

public static void main(String[] args) {

int Integer = 0; // k1

Integer int = 0; // k2

Integer ++; // k3

int++; // k4

}

A. k1

B. k2

C. k3

D. k4

B. Integer is the name of a class in Java. While it is bad practice to use the name of a class as your local variable name, this is legal. Therefore, k1 does compile. It is not legal to use a reserved word as a variable name. All of the primitives including int are reserved words.Therefore, k2 does not compile, and Option B is the answer. Line k4 doesn’t compile either, but the question is first line to not compile.

22. Suppose foo is a reference to an instance of a class. Which of the following is not true about foo.bar?

A. bar is an instance variable.

B. bar is a local variable.

C. It can be used to read from bar.

D. It can be used to write to bar.

22. B. Dot notation is used for both reading and writing instance variables, assuming they are in scope. It cannot be used for referencing local variables, making Option B the correct answer.

25. Which is correct about a local variable of type String?

A. It defaults to an empty string.

B. It defaults to null.

C. It does not have a default value.

D. It will not compile without initializing on the declaration line.

C. Local variables do not have a default initialization value. If they are referenced before being set to a value, the code does not compile. Therefore, Option C is correct. If the variable was an instance variable, Option B would be correct. Option D is tricky. A local variable will compile without an initialization if it isn’t referenced anywhere or it is assigned a value before it is referenced.

26. Of the types double, int, long, and short, how many could fill in the blank code output 0?

static defaultValue;

public static void main(String[] args) {

System.out.println(defaultValue);

}

A. One

B. Two

C. Three

D. Four

C. Since defaultValue is an instance variable, it is automatically initialized to the corresponding value for that type. For double, that value is 0.0. By contrast, it is 0 for int,long, and short.

27. Which of the following is true about primitives?

A. You can call methods on a primitive.

B. You can convert a primitive to a wrapper class object simply by assigning it.

C. You can convert a wrapper class object to a primitive by calling valueOf().

D. You can store a primitive directly into an ArrayList.

B. Option B is an example of autoboxing. Java will automatically convert from primitive to wrapper class types and vice versa. Option A is incorrect because you can only call methods on an object. Option C is incorrect because this method is used for converting to a wrapper class from a String. Option D is incorrect because

31. Which two primitives have wrapper classes that are not merely the name of the primitive

with an uppercase letter?

A. byte and char

B. byte and int

C. char and int

D. None of the above

C. The wrapper class for int is Integer and the wrapper class for char is Character.All other primitives have the same name. For example, the wrapper class for boolean is Boolean.

33. Which statement is true about primitives?

A. Primitive types begin with a lowercase letter.

B. Primitive types can be set to null.

C. String is a primitive.

D. You can create your own primitive types.

A. An example of a primitive type is int. All the primitive types are lowercase, making Option A correct. Unlike object reference variables, primitives cannot reference null.String is not a primitive as evidenced by the uppercase letter in the name and the fact that we can call methods on it. You can create your own classes, but not primitives.

34. How do you force garbage collection to occur at a certain point?

A. Call System.forceGc()

B. Call System.gc()

C. Call System.requireGc()

D. None of the above

D. While you can suggest to the JVM that it might want to run a garbage collection cycle,the JVM is free to ignore your suggestion. Option B is how to make this suggestion. Since garbage collection is not guaranteed to run, Option D is correct.

35. How many of the String objects are eligible for garbage collection right before the end of

the main method?

public static void main(String[] fruits) {

String fruit1 = new String("apple");

String fruit2 = new String("orange");

String fruit3 = new String("pear");

fruit3 = fruit1;

fruit2 = fruit3;

fruit1 = fruit2;

}

A. None

B. One

C. Two

D. Three

C. All three references point to the String apple. This makes the other two String objects eligible for garbage collection and Option C correct.

36. Which of the following can fill in the blanks to make this code compile?

d = new (1\_000\_000.00);

A. double, double

B. double, Double

C. Double, double

D. None of the above

B. A constructor can only be called with a class name rather than a primitive, making Options A and C incorrect. The newly constructed Double object can be assigned to either a double or Double thanks to autoboxing. Therefore, Option B is correct.

43. Which of the following is the output of this code, assuming it runs to completion?

package store;

public class Toy {

public void play() {

System.out.print("play-");

}

public void finalizer() {

System.out.print("clean-");

}

public static void main(String[] fun) {

Toy car = new Toy();

car.play();

System.gc();

Toy doll = new Toy();

doll.play();

}

}

B. If there was a finalize() method, this would be a different story. However, the method here is finalizer. Tricky! That’s just a normal method that doesn’t get called automatically. Therefore clean is never output.

45. Fill in the blanks to indicate whether a primitive or wrapper class can be assigned without

the compiler using the autoboxing feature.

first = Integer.parseInt("5");

second = Integer.valueOf("5");

A. int, int

B. int, Integer

C. Integer, int

D. Integer, Integer

B. The parseInt() methods return a primitive. The valueOf() methods return a wrapper class object. In real code, autoboxing would let you assign the return value to either a primitive or wrapper class. In terms of what gets returned directly, Option B is correct.

46. How many objects are eligible for garbage collection right before the end of the main method?

1: public class Person {

2: public Person youngestChild;

3:

4: public static void main(String... args) {

5: Person elena = new Person();

6: Person diana = new Person();

7: elena.youngestChild = diana;

8: diana = null;

9: Person zoe = new Person();

10: elena.youngestChild = zoe;

11: zoe = null;

12: }

13: }

A. None

B. One

C. Two

D. Three

B. On line 9, all three objects have references. The elena and zoe objects have a direct reference. The diana object is referenced through the elena object. On line 10, the reference to the diana object is replaced by a reference to the zoe objec

48. Which of the following is not a possible output of this code, assuming it runs to completion?

package store;

public class Toy {

public void play() {

System.out.print("play-");

}

public void finalize() {

System.out.print("clean-");

}

public static void main(String[] args) {

Toy car = new Toy();

car.play();

System.gc();

Toy doll = new Toy();

doll.play();

}

}

A. play-

B. play-play-

C. play-play-clean-

D. play-play-clean-clean

A. Remember that garbage collection is not guaranteed to run on demand. If it doesn’t run at all, Option B would be output. If it runs at the requested point, Option C would be output. If it runs right at the end of the main() method, Option D would be output. Option A is the correct answer because play is definitely called twice. Note that you are unlikely to see all these scenarios if you run this code because we have not used enough memory for garbage collection to be worth running. However, you still need to be able to answer what could happen regardless of it being unlikely.

49. Which converts a primitive to a wrapper class object without using autoboxing?

A. Call the asObject() method

B. Call the constructor of the wrapper class

C. Call the convertToObject() method

D. Call the toObject() method

B. Each wrapper class has a constructor that takes the primitive equivalent. The methods mentioned in Options A, C, and D do not exist.

## 3.Operators and Decision Constructs

2. What is the value of tip after executing the following code snippet?

int meal = 5;

int tip = 2;

int total = meal + (meal>6 ? ++tip : --tip);

A. 1

B. 2

C. 3

D. 6

A. Remember that in ternary expressions, only one of the two right-most expressions are evaluated. Since meal>6 is false, ––tip is evaluated and ++tip is skipped. The result is that tip is changed from 2 to 1, making Option A the correct answer. The value of total is 6, since the pre-increment operator was used on tip, although you did not need to know this to solve the question

8. Which statement about ternary expressions is true?

A. In some cases, both expressions to the right of the conditional operator in a ternary

expression will be evaluated at runtime.

B. Ternary expressions require parentheses for proper evaluation.

C. The ternary expressions are a convenient replacement for an if-then-else statement.

D. Ternary expressions support int and boolean expressions for the left-most operand.

C. Option A is incorrect as only one of the two right-hand expressions is evaluated at runtime.Parentheses are often helpful for reading ternary expressions but are not required,making Option B incorrect. Option C is a correct statement about ternary operators as theyare commonly used to replace short if-then-else statements. Finally, Option D isincorrect as only boolean expressions are permitted in the left-most operand of a ternary expression.

18. Given the following code snippet, assuming dayOfWeek is an int, what variable type of saturday is not permitted?

final saturday = 6;

switch(dayOfWeek) {

default:

System.out.print("Another Weekday");

break;

case saturday:

System.out.print("Weekend!");

}

A. byte

B. long

C. int

D. None of the above

B. Any value that can be implicitly promoted to int will work for the case statement with an int input. **\*\*\*Since switch statements do not support long values\*\*\*,** and long cannot be converted to int without a possible loss of data, Option B is the correct answer.

28. How many 1s are outputted when the following application is compiled and run?

package city;

public class Road {

public static void main(String... in) {

int intersections = 100;

int streets = 200;

if (intersections < 150) {

System.out.print("1");

} else if (streets && intersections > 1000) {

System.out.print("2");

} if (streets < 500)

System.out.print("1");

else

System.out.print("2");

}

}

A. None

B. One

C. Two

D. The code does not compile.

D. The code does not compile, making Option D the correct answer. The reason the code does not compile is due to the test in the second if-then statement. The expression (streets && intersections > 1000) is invalid because streets is not a Boolean expression and cannot be used as the left-hand side of the conjunctive logical && operator. The line of code is designed to resemble the corrected expression (streets > 1000 && intersections > 1000. Notice the fixed expression requires two relational > operators. If the second if-then statement was corrected, then the application would compile and produce two 1’s, making Option C the correct answer.

34. Which of the following is not a possible result of executing the following application?

public class ConditionallyLogical {

public static void main(String... data) {

if(data.length>=1&& (data[0].equals("sound") || data[0].equals ("logic"))&& data.length<2) {

System.out.print(data[0]);

}

}

}

A. Nothing is printed.

B. sound is printed.

C. The application throws an exception at runtime.

D. logic is printed.

C. The key to understanding this question is to remember that the conditional conjunction && operator only executes the right-hand side of the expression if the left-hand side of the expression is true. If data is an empty array, then the expression ends early and nothing is output. The second part of the expression will return true if data’s first element is sound or logic. Since we know from the first part of the statement that data is of length at least one, no exception will be thrown. The final part of the expression with data.length<2 doesn’t change the output when data is an array of size one. Therefore, sound and logic are both possible outputs. For these reasons, Option C is the only result that is unexpected at runtime.

38. What variable type of red allows the following application to compile?

package tornado;

public class Kansas {

public static void main(String[] args) {

int colorOfRainbow = 10;

red = 5;

switch(colorOfRainbow) {

default:

System.out.print("Home");

break;

case red:

System.out.print("Away");

}

}

}

A. long

B. double

C. int

D. None of the above

D. **\*\*\*The value of a case statement must be constant, a literal value, or final variable and No variable type allows\*\*\***. Since red is missing the final attribute, no variable type allows the code to compile, making Option D the correct answer.

42. What is the output of the following application?

package yoyo;

public class TestGame {

public String runTest(boolean spinner, boolean roller) {

if(spinner = roller) return "up";

else return roller ? "down" : "middle";

}

public static final void main(String pieces[]) {

final TestGame tester = new TestGame();

System.out.println(tester.runTest(false,true));

}

}

A. up

B. middle

C. down

D. The code does not compile.

A. The code compiles without issue, so Option D is incorrect. The key here is that the if then statement in the runTest() method uses the assignment operator (=) instead of the (==) operator. The result is that spinner is assigned a value of true, and the statement (spinner = roller) returns the newly assigned value. The method then returns up, making Option A the correct answer. If the (==) operator had been used in the if-then statement, then the process would have branched to the else statement, with down being returned by the method.

46. Which of the following is not a possible result of executing the following application?

public class OutsideLogic {

public static void main(String... weather) {

System.out.print(weather[0]!=null && weather[0].equals("sunny") && !false ? "Go Outside" : "Stay Inside");

}

}

A. Nothing is printed.

B. The application throws an exception at runtime.

C. Go Outside is printed.

D. Stay Inside is printed.

A. The application uses the conditional conjunction && operator to test if weather[0] is null, but unfortunately this test does not work on zero-length arrays. Therefore, it is possible this code will throw an ArrayIndexOutOfBoundsException at runtime. The second part of the expression evaluates to true if the first input of weather matches sunny. The final part of the expression, && !false, is a tautology in that it is always true and has no impact on the expression. Either an exception will be thrown or text will be output, based on the value of weather, therefore Option A is the correct answer.

## 4.Arrays

13. How many of the following are legal declarations?

float[] lion = new float[];

float[] tiger = new float[1];

float[] bear = new[] float;

float[] ohMy = new[1] float;

A. None

B. One

C. Two

D. Three

B. Since no elements are being provided when creating the arrays, a size is required. Therefore,lion and bear are incorrect. The braces containing the size are required to be after the type, making ohMy incorrect. The only one that is correct is tiger, making the correct answer Option B.

18. Which is the first line to prevent this code from compiling and running without error?

char[][] ticTacToe = new char[3,3]; // r1

ticTacToe[1][3] = 'X'; // r2

ticTacToe[2][2] = 'X';

ticTacToe[3][1] = 'X';

System.out.println(ticTacToe.length + " in a row!"); // r3

A. Line r1

B. Line r2

C. Line r3

D. None of the above

A. A multi-dimensional array is created with multiple sets of size parameters. The first line should be char[] ticTacToe = new char[3][3];. Therefore, Option A is the answer.

19. How many objects are created when running the following code?

Integer[] lotto = new Integer[4];

lotto[0] = new Integer(1\_000\_000);

lotto[1] = new Integer(999\_999);

A. Two

B. Three

C. Four

D. Five

B. The first line creates one object; the array itself. While there are four references to null in that array, none of those are objects. The second line creates one object and points one of the array references to it. So far there are two objects: the array itself and one object it is referencing. The third line does the same, bringing up the object count to three. Therefore, Option B is correct.

22. What happens when calling the following method with a non-null and non-empty array?

public static void addStationName(String[] names) {

names[names.length] = "Times Square";

}

A. It adds an element to the array the value of which is Times Square.

B. It replaces the last element in the array with the value Times Square.

C. It does not compile.

D. It throws an exception.

D. names.length is the number of elements in the array. The last valid index in the array is one less than names.length. In Java, arrays do not resize automatically. Therefore, the code throws an ArrayIndexOutOfBoundsException.

25. What is a possible output of the following code?

String[] strings = new String[2];

System.out.println(strings);

A. [null, null]

B. [,]

C. [Ljava.lang.String;@74a14482

D. None of the above

C. Calling toString() on an array doesn’t output the contents of the array, making Option C correct. If you wanted Option A to be the answer, you’d have to call Arrays.toString(strings).

28. What is the result of running the following program?

1: package fun;

2: public class Sudoku {

3: static int[][] game = new int[6][6];

4:

5: public static void main(String[] args) {

6: game[3][3] = 6;

7: Object[] obj = game;

8: obj[3] = "X";

9: System.out.println(game[3][3]);

10: }

11: }

A. X

B. The code does not compile.

C. The code compiles but throws a NullPointerException at runtime.

D. The code compiles but throws a different exception at runtime.

D. Line 6 assigns an int to a cell in a 2D array. This is fine. Line 7 casts to a general Object[]. This is dangerous, but legal. Why is it dangerous, you ask? That brings us to line8. The compiler can’t protect us from assigning a String to the int[] because the reference is more generic. Therefore, line 8 throws an ArrayStoreException because the type is incorrect, and Option D is correct. You couldn’t have assigned an int on line 8 either because obj[3] is really an int[] behind the scenes and not an int.

29. What does the following output?

String[] os = new String[] { "Mac", "Linux", "Windows" };

Arrays.sort(os);

System.out.println(Arrays.binarySearch(os, "RedHat"));

A. -1

B. -2

C. -3

D. The output is not defined.

C. The code sorts before calling binarySearch, so it meets the precondition for that method. The target string of "RedHat" is not found in the sorted array. If it was found, it would be between the second and third element. The rule is to take the negative index of where it would be inserted and subtract 1. It would need to be inserted as the third element.Since indexes are zero based, this is index 2. We take the negative, which is -2, and subtract 1, giving -3. Therefore, Option C is correct.

40. What is the result of the following when called as java counting.Binary?

package counting;

import java.util.\*;

public class Binary {

public static void main(String... args) {

Arrays.sort(args);

System.out.println(Arrays.toString(args));

}

}

A. null

B. []

C. The code does not compile.

D. The code compiles but throws an exception at runtime.

B. Since no arguments are passed from the command line, this creates an empty array.Sorting an empty array is valid and results in an empty array. Therefore, Option B is correct.

47. What does the following output?

String[] os = new String[] { "Linux", "Mac", "Windows" };

System.out.println(Arrays.binarySearch(os, "Linux"));

A. 0

B. 1

C. 2

D. The output is not defined.

A. Java requires having a sorted array before calling binarySearch(). You do not have to call Arrays.sort to perform the sort though. This array happens to already be sorted, so it meets the precondition. The target string of "Linux" is the first element in the array. Since Java uses zero-based indexing, the answer is Option A.

## 5.Loop Constructs

**-break & continue can be used in Loops & if statements**

**- In loops null==null allow**

String x = null;

while(x==null){}

**- labels: only allowed in Loops , Not in If's**

8. Which of the following statements is/are true?

I. A traditional for loop can iterate through an array starting from index 0.

II. A traditional for loop can iterate through an array starting from the end.

A. Only I

B. Only II

C. Both statements

D. Neither statement

C. With a traditional for loop, you control the order in which indexes are visited in code. This means you can loop through an array in ascending or descending order, and Option C is correct.

9. Which of the following statements is/are true?

I. A for-each loop can iterate through an array starting from index 0.

II. A for-each loop can iterate through an array starting from the end.

A. Only I

B. Only II

C. Both statements

D. Neither statement

A. With a for-each loop, the loop order is determined for you. With an array, this means starting with index 0, and Option A is correct. A traditional for loop allows you to control the order and iterate in either order.

16. What is the output of the following code?

package chicago;

public class Loop {

private static int count;

private static String[] stops = new String[] { "Washington",

"Monroe", "Jackson", "LaSalle" };

public static void main(String[] args) {

while (count < stops.length) {

if (stops[count++].length() < 8) {

break;

}

}

System.out.println(count);

}

}

A. 1

B. 2

C. 4

D. The code does not compile.

B. Since count is a class variable that isn’t specifically initialized, it defaults to 0. On the first iteration of the loop, "Washington", is 11 characters and count is set to 1. The if statement’s body is not run. The loop then proceeds to the next iteration. This time, the post-increment operator uses index 1 before setting count to 2. "Monroe" is checked, which is only 6 characters. The break statement sends the execution to after the loop and 2 is output. Option B is correct.

23. How many of these statements can be inserted after the println to have the code flow follow the arrow in this diagram?

break;

break letters;

break numbers;

--->letters: for (char ch='a'; ch<='z'; ch++) {

| numbers: for (int n=0; n<=10; n++) {

| System.out.println(ch);

--------------

}

}

A. None

B. One

C. Two

D. Three

C. In this figure, we want to end the inner loop and resume execution at the letters label.This means we only want to break out of the inner loop. A break statement does just that.It ends the current loop and resumes execution immediately after the loop, making break;a correct answer. The break numbers; statement explicitly says which loop to end, which does the same thing, making it correct as well. By contrast, break letters; ends the outer loop, causing the code only to run the println() once. Therefore, two statements correctly match the diagram, and Option C is correct.

24. Using the diagram in the previous question, how many of these statements can be inserted after the println to have the code flow follow the arrow in the diagram?

continue;

continue letters;

continue numbers;

A. None

B. One

C. Two

D. Three

B. In this figure, we want to end the inner loop and resume execution at the letters label.The continue letters; statement does that. The other two statements resume execution at the inner loop. Therefore, only the second statement correctly matches the diagram, and Option B is correct.

30. What is the result of the following?

int count = 10;

List<Character> chars = new ArrayList<>();

do {

chars.add('a');

for (Character x : chars) count -=1;

} while (count > 0);

System.out.println(chars.size());

A. 3

B. 4

C. The code does not compile.

D. None of the above

B. On the first iteration through the outer loop, chars becomes 1 element. The inner loop is run once and count becomes 9. On the second iteration through the outer loop, chars becomes 2 elements. The inner loop runs twice so count becomes 7. On the third iteration through the outer loop, chars becomes 3 elements. The inner loop runs three times so count becomes 4. On the fourth iteration through the outer loop, chars becomes 4 elements. The inner loop runs four times so count becomes 0. Then both loops end. Therefore, Option B is correct.

36. What is the output of the following?

public class Shoelaces {

public static void main(String[] args) {

String tie = null;

while (tie == null)

tie = "shoelace";

System.out.print(tie);

}

}

A. null

B. shoelace

C. shoelaceshoelace

D. None of the above

B. The first time the loop condition is checked, the variable tie is null. The loop body executes, setting tie. Despite the indention, there are no brackets surrounding the loop body so the print does not run yet. Then the loop condition is checked and tie is not null. The print runs after the loop, printing out shoelace once, making Option B correct.

37. The following code outputs a single letter x. What happens if you remove lines 25 and 28?

23: String race = "";

24: loop:

25: do {

26: race += "x";

27: break loop;

28: } while (true);

29: System.out.println(race);

A. It prints an empty string.

B. It still outputs a single letter x.

C. It no longer compiles.

D. It becomes an infinite loop.

C. Line 27 refers to a loop label. While the label is still present, it no longer points to a loop. This causes the code to not compile, and Option C is correct.

38. What is the output of the following code?

package chicago;

public class Loop {

private static int count;

private static String[] stops = new String[] { "Washington",

"Monroe", "Jackson", "LaSalle" };

public static void main(String[] args) {

while (count < stops.length) {

if (stops[count++].length() < 8) {

continue;

}

}

System.out.println(count);

}

}

A. 1

B. 2

C. 4

D. The code does not compile

C. The continue statement is useless here since there is no code later in the loop to skip.The continue statement merely resumes execution at the next iteration of the loop, which is what would happen if the if-then statement was empty. Therefore, count increments for each element of the array. The code outputs 4, and Option C is correct.

48. What is the output of the following?

12: int result = 8;

13: for: while (result > 7) {

14: result++;

15: do {

16: result--;

17: } while (result > 5);

18: break for;

19: }

20: System.out.println(result);

A. 5

B. 8

C. The code does not compile.

D. The code compiles but throws an exception at runtime

C. Remember to look for basic errors before wasting time tracking the flow. In this case,the label of the loop is trying to use the keyword for. This is not allowed, so the code does not compile. If the label was valid, Option A would be correct.

49. What is the output of the following?

boolean baloonInflated = false;

do {

if (!baloonInflated) {

baloonInflated = true;

System.out.print("inflate-");

}

} while (baloonInflated);

System.out.println("done");

A. done

B. inflate-done

C. The code does not compile.

D. This is an infinite loop.

D. On the first iteration of the loop, the if statement executes printing inflate-. Then the loop condition is checked. The variable baloonInflated is true, so the loop condition is true and the loop continues. The if statement no longer runs, but the variable never changes state again, so the loop doesn’t end.

## 6.Methods and Encapsulation

-**static imports are used with members of the class, not a class name.**

4. What is true about the following program?

public class Dolls {

public void nested() {

nested(2, true);// g1

}

public int nested(int level, boolean height) {

return nested(level);

}

public int nested(int level) {

return level + 1;// g2

};

public static void main(String[] outOfTheBox) {

System.out.print(new Dolls().nested());

}

}

A. It compiles successfully and prints 3 at runtime.

B. It does not compile because of line g1.

C. It does not compile because of line g2.

D. It does not compile for some other reason.

D. The no-argument version of the nested() method does not return a value, and trying to output a void return type in the print() method throws an exception at runtime.

9. Fill in the blank: A variable is always available to all instances of the class.

A. public

B. local

C. static

D. instance

C. The only variables always available to all instances of the class are those declared static; therefore, Option C is the correct answer. Option A may seem correct, but public variables are only available if a reference to the object is maintained among all instances. Option B is incorrect because there is no local keyword in Java. Option D is also incorrect because a private instance variable is only accessible within the instance that created it.

10. Which line of code, inserted at line p1, causes the application to print 5?

public class Jump {

private int rope = 1;

protected boolean outside;

public Jump() {

// p1

outside = true;

}

public Jump(int rope) {

this.rope = outside ? rope : rope+1;

}

public static void main(String[] bounce) {

System.out.print(new Jump().rope);

}

}

A. this(4);

B. new Jump(4);

C. this(5);

D. rope = 4;

A. the default initialization of a boolean instance variable is false, making outside false at line p1. Therefore, this(4) will cause rope to be set to 5, while this(5) will cause rope to be set to 6.

12. Given the following class, what should be inserted into the two blanks to ensure the class data is properly encapsulated?

public class Box {

public String stuff;

String () {

return stuff;

}

public void setStuff(String stuff) {

this.stuff = stuff;

}

}

A. public and getStuff

B. private and isStuff

C. public and setStuff

D. None of the above

D. The class data, stuff, is declared public, allowing any class to modify the stuff variable and making the implementation inherently unsafe for encapsulation. Therefore, there are no values that can be placed in the two blanks to ensure the class properly encapsulates its data, making Option D correct. Note that if stuff was declared private, Options A, B, and C would all be correct. Encapsulation does not require JavaBean syntax, just that the internal attributes are protected from outside access, which all of these sets of values do achieve.

15. Given the following application, which diagram best represents the state of the mySkier,mySpeed, and myName variables in the main() method after the call to the slalom() method?

package slopes;

public class Ski {

private int age = 18;

private static void slalom(Ski racer, int[] speed, String name) {

racer.age = 18;

name = "Wendy";

speed = new int[1];

speed[0] = 11;

racer = null;

}

public static void main(String... mountain) {

final Ski mySkier = new Ski();

mySkier.age = 16;

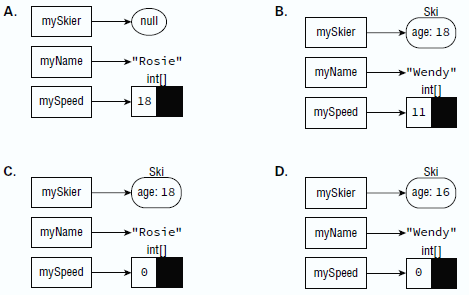
final int[] mySpeed = new int[1];

final String myName = "Rosie";

slalom(mySkier,mySpeed,myName);

}

}//IMG



C. To solve this problem, it helps to remember that Java is a pass-by-value language in which copies of primitives and object references are sent to methods. This also means that an object’s data can be modified within a method and shared with the caller, but not the reference to the object. Any changes to the object’s reference within the method are not carried over to the caller. In the slalom() method, the Ski object is updated with an age value of 18. Although, the last line of the slalom() method changes the variable value to null, it does not affect the mySkier object or reference in the main() method. Therefore,the mySkier object is not null and the age variable is set to 18, making Options A and D incorrect. Next, the name variable is reassigned to the Wendy object, but this does not change the reference in the main() method, so myName remains Rosie. Finally, the speed array is assigned a new object and updated. Since the array is updated after the reference is reassigned, it does not affect the mySpeed array in the main() method. The result is that mySpeed continues to have a single element with the default int value of 0. For these reasons,Option B is incorrect, and Option C is correct.

18. Which of the following data types can be modified after they are passed to a method as an argument?

A. int[]

B. String

C. long

D. boolean

A. Option B is incorrect because String values are immutable and cannot be modified.Options C and D are also incorrect since variables are passed by value, not reference, in Java. Option A is the correct answer. The contents of an array can be modified when passed to a method, since a copy of the reference to the object is passed. For example, the method can change the first element of a non-empty array.

20. Given a method with one of the following return types, which data type prevents the return statement from being used within the method?

A. byte

B. String

C. void

D. None of the above

D. Options A and B are incorrect because a method with a non-void return type requires that the method return a value using the return statement. Option C is also incorrect since a method with a void return type can still call the return command with no values and exit the method. Therefore, Option D is the correct answer.

21. How many final modifiers would need to be removed for this application to compile?

public final class Games {

public final static int finish(final int score) {

final int win = 3;

final int result = score++ < 5 ? 2 : win;

return result+=win;

}

public static void main(final String[] v) {

System.out.print(finish(Integer.parseInt(v[0])));

}

}

A. None

B. One

C. Two

D. The code will not compile regardless of the number of final modifiers that are removed

C. The finish() method modifies two variables that are marked final, score and result. The score variable is modified by the post-increment ++ operator, while the result variable is modified by the compound addition += operator. Removing both final modifiers allows the code to compile. For this reason, Option C is the correct answer

24. Which statement(s) about the following class would help to properly encapsulate the data in the class?

package shield;

public class Protect {

private String material;

protected int strength;

public int getStrength() {

return strength;

}

public void setStrength(int strength) {

this.strength = strength;

}

}

I. Change the access modifier of strength to private.

II. Add a getter method for material.

III. Add a setter method for material.

A. I

B. II and III

C. I, II, and III

D. None, the data in the class is already encapsulated.

A. The access modifier of strength is protected, so Changing the value to private would improve encapsulation. Alternatively, the second and third statements do not improve the encapsulation of the class.Therefore, OptionA is the correct answer.

26. Which of the following lines of code can be inserted in the line below that would allow the

class to compile?

package farm;

public class Coop {

public final int static getNumberOfChickens() {

// INSERT CODE HERE

}

}

A. return 3.0;

B. return 5L;

C. return 10;

D. None of the above

D. The code does not compile, regardless of what is inserted into the line because the method signature is invalid. The return type, int, should go before the method name and after any access, final, or static modifiers. Therefore, Option D is the correct answer. If

the method was fixed, by swapping the order of int and static in the method declaration, then Option C would be the correct answer. Options A and B are still incorrect, though, since each uses a return type that cannot be implicitly converted to int.

27. Which of the following is a true statement about passing data to a method?

A. A change made to a primitive value passed to a method is reflected in the calling method.

B. A change made to the data within an object passed to a method is reflected in the calling method.

C. Reassigning an object reference passed to a method is reflected in the calling method.

D. A change made to a boolean value passed to a method is reflected in the calling method.

B. Java uses pass-by-value, so changes made to primitive values and object references passed to a method are not reflected in the calling method. For this reason, Options A and C are incorrect statements. Option D is also an invalid statement because it is a special case of Option A. Finally, Option B is the correct answer. Changes to the data within an object are visible to the calling method since the object that the copied reference points to is the same.

30. Given the following two classes, each in a different package, which line inserted below allows the second class to compile?

package clothes;

public class Store {

public static String getClothes() { return "dress"; }

}

package wardrobe;

// INSERT CODE HERE

public class Closet {

public void borrow() {

System.out.print("Borrowing clothes: "+getClothes());

}

}

A. static import clothes.Store.getClothes;

B. import clothes.Store.\*;

C. import static clothes.Store.getClothes;

D. import static clothes.Store;

C. Option A is incorrect because the keywords static and import are reversed. The Closet class uses the method getClothes() without a reference to the class name Store, therefore a static import is required. For this reason, Option B is incorrect since it is missing the static keyword. Option D is also incorrect since static imports are used with members of the class, not a class name. Finally, Option C is the correct answer since it properly imports the method into the class using a static import.

31. What access modifier is used to mark class members package-private?

A. private

B. default

C. protected

D. None of the above

D. In Java, the lack of an access modifier indicates that the member is package-private,therefore Option D is correct. Note that the default keyword is used for interfaces and switch statements, and is not an access modifier.

32. How many lines of the following program contain compilation errors?

package sky;

public class Stars {

private int inThe = 4;

public void Stars() {

super();

}

public Stars(int inThe) {

this.inThe = this.inThe;

}

public static void main(String[] endless) {

System.out.print(new sky.Stars(2).inThe);

}

}

A. None

B. One

C. Two

D. Three B.

The code does not compile, so Option A is incorrect. The class contains constructor and one method. The first method, Stars(), looks a lot like a no-argument constructor, but since it has a return value of void, it is a method, not a constructor. Since only constructors

can call super(), the code does not compile due to this line. The only constructor in this class, which takes an int value as input, performs a pointless assignment, assigning a variable to itself. While this assignment has no effect, it does not prevent the code from compiling. Finally, the main() method compiles without issue since we just inserted the full package name into the class constructor call. This is how a class that does not use an import statement could call the constructor. Since the method is in the same class, and therefore the same package, it is redundant to include the package name but not disallowed. Because only one line causes the class to fail to compile, Option B is correct.

35. Which of the following statements about overloaded methods are true?

I. Overloaded methods must have the same name.

II. Overloaded methods must have the same return type.

III. Overloaded methods must have a different list of parameters.

A. I

B. I and II

C. I and III

D. I, II, and III

C. Overloaded methods have the same name but a different list of parameters, can have the same or different return types. Therefore, Option C is the correct answer.

36. How many lines of code would need to be removed for the following class to compile?

public class Week {

private static final String monday;

String tuesday;

final static wednesday = 3;

final protected int thursday = 4;

}

A. One

B. Two

C. Three

D. The code will not compile regardless of the number of lines removed.

C. The declaration of monday does not compile, because the value of a static final variable must be set when it is declared or in a static initialization block. The declaration of tuesday is fine and compiles without issue. The declaration of wednesday does not compile because there is no data type for the variable. Finally, the declaration of thursday does not compile because the final modifier cannot appear before the access modifier. For these reasons, Option C is the correct answer.

37. What is the output of the following application?

public class Puppy {

public static int wag = 5; // q1

public void Puppy(int wag) { // q2

this.wag = wag;

}

public static void main(String[] tail) {

System.out.print(new Puppy(2).wag); // q3

}

}

A. 2

B. It does not compile because of line q1.

C. It does not compile because of line q2.

D. It does not compile because of line q3.

D. The Puppy class does not declare a constructor, so the default no-argument constructor is automatically inserted by the compiler. What looks like a constructor in the class is actually a method that has a return type of void. Therefore, the line in the main() method to create the new Puppy(2) object does not compile, since there is no constructor capable of taking an int value, making D correct.

39. What is the output of the following application?

public class Phone {

private int size;

public Phone(int size) {this.size=size;}

public static void sendHome(Phone p, int newSize) {

p = new Phone(newSize);

p.size = 4;

}

public static final void main(String... params) {

final Phone phone = new Phone(3);

sendHome(phone,7);

System.out.print(phone.size);

}

}

A. 3

B. 4

C. 7

D. The code does not compile.

A. The code compiles without issue, so Option D is incorrect. The key here is that Java uses pass by value to send object references to methods. Since the Phone reference p was reassigned in the first line of the sendHome() method, any changes to the p reference were made to a new object. In other words, no changes in the sendHome() method affected the object that was passed in. Therefore, the value of size was the same before and after the method call, making the output 3 and Option A the correct answer.

43. Which of the following is not a true statement?

A. The first line of every constructor is a call to the parent constructor via the super() command.

B. A class does not have to have a constructor explicitly defined.

C. A constructor may pass arguments to the parent constructor.

D. final instance variable whose value is not set when they are declared or in an initialization block should be set by the constructor.

A. Option A is the correct answer because the first line of a constructor could be this() or super(), making it an untrue statement. Option B is a true statement because the compiler will insert the default no-argument constructor if one is not defined. Option C is also a true statement, since zero or more arguments may be passed to the parent constructor, if the parent class defines such constructors. Option D is also true. The value of a final instance variable should be set when it is declared, in an initialization block, or in a constructor.

47. What is the output of the following application?

public class Football {

public static Long getScore(Long timeRemaining) {

return 2\*timeRemaining; // m1

}

public static void main(String[] refs) {

final int startTime = 4;

System.out.print(getScore(startTime)); // m2

}

}

A. 8

B. The code does not compile because of line m1.

C. The code does not compile because of line m2.

D. The code compiles but throws an exception at runtime.

C. The variable startTime can be automatically converted to Integer by the compiler, but Integer is not a subclass of Long. Therefore, the code does not compile due the wrong variable type being passed to the getScore() method on line m2, and Option C is correct.

## 7. Inheritance

-Default methods overriding possible in concrete class with same method signature by removing 'default' keyword.

-one class implement two interfaces that both define the same default method signature leads to a compiler error, unless the class overrides the default method

1. How many lines of the following program contain compilation errors?

class Cinema {

private String name;

public Cinema(String name) {this.name = name;}

}

public class Movie extends Cinema {

public Movie(String movie) {}

public static void main(String[] showing) {

System.out.print(new Movie("Another Trilogy").name);

}

}

A. None

B. One

C. Two

D. Three

C. The code does not compile, so Option A is incorrect. This code does not compile for two reasons. First, the name variable is marked private in the Cinema class, which means it cannot be accessed directly in the Movie class. Next, the Movie class defines a constructor that is missing an explicit super() statement. Since Cinema does not include a no-argument constructor, the no-argument super() cannot be inserted automatically by the compiler without a compilation error. For these two reasons, the code does not compile, and Option C is the correct answer.

7. What is the output of the following application?

class Automobile {

private final String drive() { return "Driving vehicle"; }

}

class Car extends Automobile {

protected String drive() { return "Driving car"; }

}

public class ElectricCar extends Car {

public final String drive() { return "Driving electric car"; }

public static void main(String[] wheels) {

final Car car = new ElectricCar();

System.out.print(car.drive());

}

}

A. Driving vehicle

B. Driving electric car

C. Driving car

D. The code does not compile.

The drive() method in the Car class does not override the version in the Automobile class since the method is not visible to the Car class. Therefore, the final attribute in the Automobile class does not prevent the Car class from implementing a method with the same signature. The drive() method in the ElectricCar class is a valid override of the method in the Car class, with the access modifier expanding in the subclass. For these reasons, the code compiles, and Option D is incorrect. In the main() method, the object created is an ElectricCar, even if it is assigned to a Car reference. Due to polymorphism, the method from the ElectricCar will be invoked, making Option B the correct answer.

9. How many changes need to be made to the classes below to properly override the watch()method?

class Television {

protected final void watch() {}

}

public class LCD extends Television {

Object watch() {}

}

A. One

B. Two

C. Three

D. None; the code compiles as is.

C. There are three problems with this method override. First, the watch() method is marked final in the Television class. The final modifier would have to be removed from the method definition in the Television class in order for the method to compile in the LCD class. Second, the return types void and Object are not covariant. One of them would have to be changed for the override to be compatible. Finally, the access modifier in the child class must be the same or broader than in the parent class. Since package-private is narrower than protected, the code will not compile. For these reasons, C is the correct.

14. What is the output of the following application?

interface Run {

default void walk() {

System.out.print("Walking and running!");

}

}

interface Jog {

default void walk() {

System.out.print("Walking and jogging!");

}

}

public class Sprint implements Run, Jog {

public void walk() {

System.out.print("Sprinting!");

}

public static void main() {

new Sprint().walk();

}

}

A. Walking and running!

B. Walking and jogging!

C. Sprinting!

D. The code does not compile.

C. Having one class implement two interfaces that both define the same default method signature leads to a compiler error, unless the class overrides the default method. In this case, the Sprint class does override the walk() method correctly, therefore the code compiles without issue, and C is correct.

18. Which statement about the following class is correct?

package shapes;

abstract class Triangle {

abstract String getDescription();

}

class RightTriangle extends Triangle {

protected String getDescription() { return "rt"; } // g1

}

public abstract class IsoscelesRightTriangle extends RightTriangle { // g2

public String getDescription() { return "irt"; }

public static void main(String[] edges) {

final Triangle shape = new IsoscelesRightTriangle(); // g3

System.out.print(shape.getDescription());

}

}

A. The code does not compile due to line g1.

B. The code does not compile due to line g2.

C. The code does not compile due to line g3.

D. The code compiles and runs without issue.

C. The code does not compile, so Option D is incorrect. The IsoscelesRightTriangle class is abstract; therefore, it cannot be instantiated on line g3.

19. Given that Short and Integer extend Number, what type can be used to fill in the blank in the class below to allow it to compile?

interface Horn { public Integer play(); }

abstract class Woodwind { public Short play() {return 3;} }

public final class Saxophone extends Woodwind implements Horn {

public \_\_\_ play() {

return null;

}

}

A. Integer

B. Short

C. Number

D. None of the above

D. The play() method is overridden in Saxophone for both Horn and Woodwind, so the return type must be covariant with both. Unfortunately, the inherited methods must also be compatible with each other. Since Integer is not a subclass of Short, and vice versa, there is no subclass that can be used to fill in the blank that would allow the code to compile. In other words, the Saxophone class cannot compile regardless of its implementation of play(), making Option D the correct answer.

25. Which of the following statements is correct?

A. A reference to a class can be assigned to a subclass reference without an explicit cast.

B. A reference to a class can be assigned to a superclass reference without an explicit cast.

C. A reference to an interface can be assigned to a reference of a class that implements the interface without an explicit cast.

D. A reference to a class that implements an interface can be assigned to an interface reference only with an explicit cast.

B. A reference to a class can be implicitly assigned to a superclass reference without an explicit class, making Option B the correct answer. Assigning a reference to a subclass,though, requires an explicit cast, making Option A incorrect. Option C is also incorrect because an interface does not inherit from a class. A reference to an interface requires an explicit cast to be assigned to a reference of any class, even one that implements the interface.An interface reference requires an explicit cast to be assigned to a class reference.Finally, Option D is incorrect. An explicit cast is not required to assign a reference to a class that implements an interface to a reference of the interface.

29. What is the output of the following application?

abstract class Ball {

protected final int size;

public Ball(int size) {

this.size = size;

}

}

interface Equipment {}

public class SoccerBall extends Ball implements Equipment {

public SoccerBall() {

super(5);

}

public Ball get() { return this; }

public static void main(String[] passes) {

Equipment equipment = (Equipment)(Ball)new SoccerBall().get();

System.out.print(((SoccerBall)equipment).size);

}

}

A. 5

B. The code does not compile due an invalid cast.

C. The code does not compile for a different reason.

D. The code compiles but throws a ClassCastException at runtime.

A. Although the casting is a bit much, the object in question is a SoccerBall. Since SoccerBall extends Ball and implements Equipment, it can be explicitly cast to any of those types, so no compilation error occurs. At runtime, the object is passed around and,due to polymorphism, can be read using any of those references since the underlying object is a SoccerBall. In other words, casting it to a different reference variable does not modify the object or cause it to lose its underlying SoccerBall information. Therefore, the code compiles without issue, and Option A is correct.

30. Fill in the blanks: A class that defines an instance variable with the same name as\_\_\_ a variable in the parent class is referred to as a variable, while a class that defines a static method with the same signature as a static method in a parent class is referred to as a\_\_\_method.

A. hiding, overriding

B. overriding, hiding

C. hiding, hiding

D. replacing, overriding

C. Both of these descriptions refer to variable and static method hiding, respectively,making Option C correct. Only instance methods can be overridden, making Options A and B incorrect. Option D is also incorrect because replacing is not a real term in this context.

31. Which statement about the following class is correct?

abstract class Parallelogram {

private int getEqualSides() {return 0;}

}

abstract class Rectangle extends Parallelogram {

public static int getEqualSides() {return 2;} // x1

}

public final class Square extends Rectangle {

public int getEqualSides() {return 4;} // x2

public static void main(String[] corners) {

final Square myFigure = new Square(); // x3

System.out.print(myFigure.getEqualSides());

}

}

A. The code does not compile due to line x1.

B. The code does not compile due to line x2.

C. The code does not compile due to line x3.

D. The code compiles and runs without issue.

B. The code does not compile, so Option D is incorrect. The issue here is that the override of getEqualSides() in Square is invalid. A static method cannot override a non-static method and vice versa. For this reason, Option B is the correct answer

35. How many compiler errors does the following code contain?

interface CanFly {

public void fly() {}

}

final class Bird {

public int fly(int speed) {}

}

public class Eagle extends Bird implements CanFly {

public void fly() {}

}

A. None

B. One

C. Two

D. Three

D. First of all, interfaces can only contain abstract, final, and default methods. The method fly() defined in CanFly is not marked static or default and defines an implementation, an empty {}, meaning it cannot be assumed to be abstract; therefore, the code does not compile. Next, the implementation of fly(int speed) in the Bird class also does not compile, but not because of the signature. The method body fails to return an int value. Since it is an overloaded method, if it returned a value it would compile without

issue. Finally, the Eagle class does not compile because it extends the Bird class, which is marked final and therefore, cannot be extended. For these three reasons, Option D is the correct answer.

40. What is the output of the following application?

class Math {

public final double secret = 2;

}

class ComplexMath extends Math {

public final double secret = 4;

}

public class InfiniteMath extends ComplexMath {

public final double secret = 8;

public static void main(String[] numbers) {

Math math = new InfiniteMath();

System.out.print(math.secret);

}

}

A. 2

B. 4

C. 8

D. The code does not compile.

A. The code compiles without issue, so Option D is incorrect. Java allows methods to be overridden, but not variables. Therefore, marking them final does not prevent them from being reimplemented in a subclass. Furthermore, polymorphism does not apply in the same way it would to methods as it does to variables. In particular, the reference type determines the version of the secret variable that is selected, making the output 2 and Option A the correct answer.

41. Given the following method and the fact that FileNotFoundException is a subclass of IOException, which of the following method signatures is a valid override by a subclass?

protected void dance() throws FileNotFoundException {}

A. void dance() throws IOException

B. public void dance() throws IOException

C. private void dance() throws FileNotFoundException

D. public final void dance()

D. Options A and C are incorrect because an overridden method cannot reduce the visibility of the inherited method. Option B is incorrect because an overridden method cannot declare a broader checked exception than the inherited method. Finally, Option D is the correct answer. The removal of the checked exception, the application of a broader access modifier, and the addition of the final attribute are allowed for overridden methods.

45. Fill in the blanks:\_\_\_ methods must have a different list of parameters,while\_\_\_ methods must have the exact same return type.

A. Overloaded, overridden

B. Inherited, overridden

C. Overridden, overloaded

D. None of the above

D. Trick question! Option A seems like the correct answer, but the second part of the sentence is false, regardless of whether you insert overloaded or overridden. Overridden methods must have covariant return types, which may not be exactly the same as the type in the parent class. so, D is correct answer.

46. Which of the following statements about no-argument constructors is correct?

A. If a parent class does not include a no-argument constructor, a child class cannot declare one.

B. If a parent class does not include a no-argument constructor (nor a default one inserted by the compiler), a child class must contain at least one constructor definition.

C. If a parent class contains a no-argument constructor, a child class must contain a no-argument constructor.

D. If a parent class contains a no-argument constructor, a child class must contain at least one constructor.

B. If a parent class does not include a no-argument constructor, a child class can still explicitly declare one; it just has to call an appropriate parent constructor with super(),making Option A incorrect. If a parent class does not include a no-argument constructor,the child class must explicitly declare a constructor, since the compiler will not be able to insert the default no-argument constructor, making Option B correct. Option C is incorrect because a parent class can have a no-argument constructor, while its subclasses do not. If Option C was true, then all classes would be required to have no-argument constructors since they all extend java.lang.Object, which has a no-argument constructor. Option D is also incorrect. The default no-argument constructor can be inserted into any class that directly extends a class that has a no-argument constructor. Therefore, no constructors in the subclass are required.

47. Fill in the blanks: The\_\_\_ determines which attributes exist in memory, while the\_\_\_ determines which attributes are accessible

by the caller.

A. reference type, signature

B. object type, superclass

C. reference type, object type

D. object type, reference type

D. The object type relates to the attributes of the object that exist in memory, while the reference type dictates how the object is able to be used by the caller. For these reasons, Option D is correct.

48. Given that Integer and Long are subclasses of Number, what type can be used to fill in the blank in the class below to allow it to compile?

package orchestra;

interface MusicCreator { public Number play(); }

abstract class StringInstrument { public Long play() {return 3L;} }

public class Violin extends StringInstrument implements MusicCreator {

public\_\_\_ play() {

return 12;

}

}

A. Long

B. Integer

C. Long or Integer

D. Long or Number

A. The play() method is overridden in Violin for both MusicCreator and StringInstrument, so the return type must be covariant with both. Long is a subclass of Number, and therefore, it is covariant with the version in MusicCreator. Since it matches the type in StringInstrument, it can be inserted into the blank and the code would compile.While Integer is a subclass of Number, meaning the override for MusicCreator is valid, it is not a subclass of Long used in StringInstrument. Therefore, using Integer would cause the code to not compile. Finally, Number is compatible with the version of the method in MusicCreator but not with the version in StringInstrument, because Number is a superclass of Long, not a subclass. For these reasons, Long is the only class that allows the code to compile, making Option A the correct answer.