Question 23

What can replace **<1*>** in the code to the right so that the code compiles and runs without error?

A) `private` **B)** `abstract`

C) `parent` **D)** `public`

E) More than one of the above.

Question 24

What can replace **<2*>** in the code to the right so that the code compiles and runs without error?

A) Nothing is required. **B)** `super(m)`

C) `super()` **D)** A or C

E) Any of the above.

Question 25

What can replace **<3*>** in the code to the right so that the code compiles and the `getNum` method returns the sum of values `n` and `m`?

A) `m + super.getNum()`

B) `n + m`

C) `getNum() + super.getNum()`

D) A or B

E) All of the above.

Question 26

Assuming **<1*>**, **<2*>**, and **<3*>** are filled in correctly, what is output by the line marked `//q26` in the code to the right?

A) `17 17` **B)** `7 10`

C) `7 17` **D)** `17 10`

E) There is no output due to a runtime error.

Question 27

Assuming **<1*>**, **<2*>**, and **<3*>** are filled in correctly, what is output by the line marked `//q27` in the code to the right?

A) `null`

B) `null null`

C) The output is an empty line with one space.

D) There is no output due to a compile error.

E) There is no output due to a runtime error.

```
abstract class A {
    int n;
    String s;

    int getNum() {
        return n;
    }

    <1*> String getS();
}

class B extends A {
    int m;

    public B(int m) {
        <2*>;
        this.m = m;
    }

    String getS() {
        return s;
    }

    int getNum() {
        return <3*>;
    }
}

////////////// client code ////////////
A a = new B(7);
B b = new B(10);
String s = "" + a.getNum();
s += " " + b.getNum();
out.println(s); //q26
s = a.getS() + " ";
s += b.getS();
out.println(s); //q27
```

Question 28

What is output by the code to the right?

A) `false false` **B)** `false true`

C) `true false` **D)** `true true`

E) There is no output due to a compile error.

```
String mat = "theupsidedown";
String r = "[c-w]+\\D?";
String o = "" + mat.matches(r);
r = "\\w?{8,15}";
o += " " + mat.matches(r);
out.println(o);
```

Question 29

What is output by the code to the right?

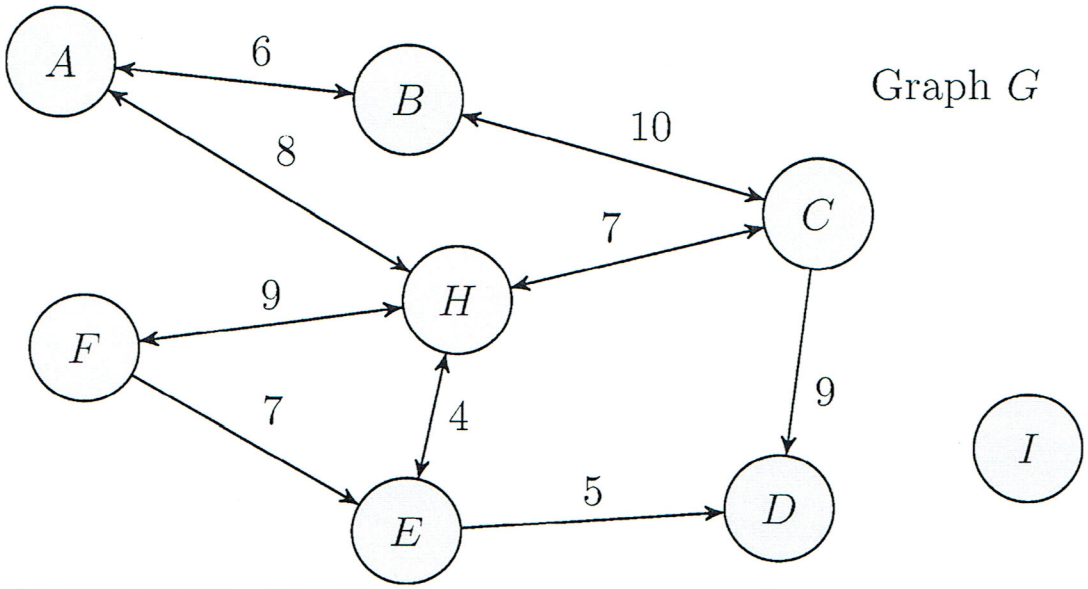
A) 98 **B)** 104

C) 106 **D)** 127

E) There is no output due to a runtime error.

```
int i = 0b1000101;
String s = Integer.toString(i, 6);
i = Integer.parseInt(s, 7);
s = Integer.toString(i, 9);
i = Integer.parseInt(s);
out.println(i);
```

Use the following graph for questions 30-33:



Question 30

Which of the following accurately describes graph G pictured above?

A) Undirected Unweighted **B)** Undirected Weighted **C)** Directed Weighted **D)** Directed Unweighted

Question 31

What is the cost of the shortest path from Node F to node B in graph G pictured above?

A) 23 **B)** 31 **C)** 25 **D)** 26 **E)** 28

Question 32

Which of the following describes Node I in graph G pictured above?

A) Isolated **B)** Sink **C)** Source **D)** All of the above. **E)** None of the above.

Question 33

What is the shortest cost path from Node A to node D in graph G pictured above?

A) $AHED$ **B)** $AHCD$ **C)** $AHFED$ **D)** $ABCD$ **E)** $ABCHED$

Question 34

What is output by the code to the right?

A) 8 **B)** 4

C) 2 **D)** 1

E) There is no output due to an error.

```
import static java.lang.System.*;

public class Q34 {
    public static final int NUM_BYTES = NUM_BITS / 8;
    public static final int NUM_BITS = Integer.SIZE;
    public static void main(String[] args) {
        out.println(NUM_BYTES);
    }
}
```

Question 35

What is output by the code to the right?

A) 8 **B)** 4 **C)** 2

D) There is no output due to a compilation error on L1.

E) There is no output due to a compilation error on L2.

```
import static java.lang.System.*;

public class Q35 {
    public final int NUM_BYTES = NUM_BITS / 8; // L1
    public static final int NUM_BITS = Long.SIZE;
    public static void main(String[] args) {
        out.println(NUM_BYTES); // L2
    }
}
```

Question 36

What is output by the code to the right?

A)
```
5
1_000_000_009
```

B)
```
5
1000000009
```

C)
```
1_000_000_009
5
```

D)
```
1000000009
5
```

E) There is no output due to an error.

Question 37

Which of the following changes to the program to the right will cause the program to run without error?

A) Do nothing. The code will run without error as is.

B) Remove the underscores from L1.

C) Change L2 to `System.out.println(5);`.

D) Wrap L2 in a `static` block (i.e., `static { ... }`).

E) Remove L3.

```
import static java.lang.System.*;

public class Q36_37_38 {
    private static final int MOD = 1_000_000_009; // L1

    out.println(5); // L2

    public static void main(String[] args) {
        out.println(MOD); // L3
    }
}
```

Question 38

Assuming that the correct choice from question 37 has been implemented in the code to the right, what will be the output of the modified program?

A)
```
5
1_000_000_009
```

B)
```
5
1000000009
```

C)
```
1_000_000_009
5
```

D)
```
1000000009
5
```

E) None of the above.

Question 39

What is the minimum number of nodes that need to be ***added*** to the tree to the right to make it a ***full*** binary tree? Write your answer in the blank provided on your answer sheet for this question.

Question 40

What is the minimum number of nodes that need to be ***added*** to the tree to the right to make it a ***complete*** binary tree? Write your answer in the blank provided on your answer sheet for this question.