

1-Greeting

Developer Code Perception Study

We would like to extend our thanks to you for your time. Your efforts are greatly appreciated!

The focus of the current study is to examine how developers interpret and reason about code. You will be presented six programming scenarios and asked to answer questions about those scenarios.

You are allowed to use the Internet if you so choose, but you are not required to do so.

Completion of the programming scenarios should take approximately **60 minutes**. Afterwards, you will be asked some basic demographic questions.

After finishing this section, we **encourage** you to take a break and return to the survey the following day (your place in the survey will automatically be saved).

Upon returning to the survey, you will be presented with a few tasks measuring your thinking process and personality. Some of the tasks include audio components which require a working microphone and headphones.

Altogether, this section will take approximately **30 minutes**.

It is important that you do all survey tasks while in an environment with little to no distractions.

Completion of all study components will qualify you for full compensation.

In the box below, please provide your **email address** at which you would like to receive your compensation details (this should be the same as the one you provided on the **Informed Consent Document**)

Once again, thank you very much for your participation!

Please click the “Next**” button to begin to the study.**

J21

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SCENARIO

You are developing a secure texting system. Text messages must be encrypted before being transferred over the network. The encrypt method takes three arguments: `alg`, a `String` value indicating the encryption algorithm, `key`, a `Key` object to be used as the encryption key, and `text`, a `String` value to be encrypted. The method returns a byte array representing the ciphertext of the original (plain) text. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.  
02 public final class CryptoUtils {  
03     public static byte[] encrypt (String alg, Key key, String text)  
04         throws GeneralSecurityException {  
05     if (text == null)  
06         return null;  
07  
08     if (text.isEmpty())  
09         return new byte[0];  
10  
11     // Create a cipher  
12     Cipher cipher = Cipher.getInstance(alg);  
13     cipher.init(Cipher.ENCRYPT_MODE, key);  
14  
15     // Encrypt the data  
16     byte[] encrypted = cipher.update(text.getBytes());  
17     return encrypted;  
18 }  
19 }
```

What will the encrypt method do when executed?

Which one statement is correct if the encrypt method gets called to encrypt an arbitrary (non-null, non-empty) text with arbitrary (yet valid) algorithm and key object?

- The encrypt method always encrypts the text correctly.
- The encrypt method never encrypts the text correctly, and it throws an exception.
- The encrypt method never encrypts the text correctly, but it does not throw an exception.
- Depending on the encryption algorithm, the encrypt method may encrypt the text correctly.
- None of the above.

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)

1 2 3 4 5 6 7 8 9 10

Confidence

How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)

1 2 3 4 5 6 7 8 9 10

Difficulty

How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)

1 2 3 4 5 6 7 8 9 10

Familiarity

How **clear** was this scenario? (1=Not clear at all; 10=Very clear)

1 2 3 4 5 6 7 8 9 10

Clarity

Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)



JX57

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SCENARIO

You are developing a web application requiring authentication and authorization. The persistent store used for credential information (usernames and passwords) is a SQL database. The database has a table called “users” with three columns: “username” (the primary key), “password”, and “roles”. You are asked to write a helper method to get a username (a String value) and return its record containing roles information to the caller. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.  
02 public class DbUtils {  
03     public static ResultSet getUser (String username)  
04         throws SQLException {  
05         String sql = "SELECT * FROM users WHERE username = ?";  
06  
07         // Get a connection from the connection pool:  
08         Connection conn = DbUtils.getConnectionPool().getConnection();  
09         PreparedStatement stmt = conn.prepareStatement(sql);  
10         stmt.setString(1, username);  
11         return stmt.executeQuery();  
12     }  
13 }
```

What will the getUser method do when executed?

If one calls the getUser method with an arbitrary String value given as username, which one statement is correct?

- The method reads and returns the roles field.
- The method may read and return the username, roles, and password fields.
- The method may read and return information from all users.

- The method may read and write information from all users.
- None of the above.

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)



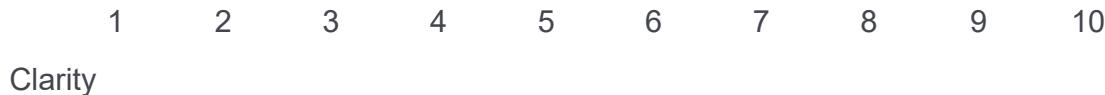
How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (1=Not clear at all; 10=Very clear)



Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)



J01

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SCENARIO

You are developing a library for file operations (e.g., copy, move). For the copy operation, you write a method that takes three arguments: a source file's path, a destination file's path, and a boolean flag indicating if the destination file should be overwritten. The following is an implementation of the copy method. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class FileUtils {
03     /**
04      * This method copies the contents of the specified source file
05      * to the specified destination file. The source file and the
06      * directory holding the destination file have to exist.
07      * If 'overwrite' argument is true, then the method will
08      * overwrite the destination file if it exists.
09      *
10     * @param source
11     *         the path to an existing file
12     * @param destination
13     *         the path of a destination file
14     * @param overwrite
15     *         whether the copy method should overwrite existing
16     *         destination file
17     * @return true, if the operation succeeded, otherwise false
18     * @throws NullPointerException if source or destination is null
19     *         IOException if an I/O error occurs
20     */
21     public static boolean copy (File source, File destination,
22                               boolean overwrite) throws IOException {
23         InputStream input = null;
24         OutputStream output = null;
25         try {
26             if (!overwrite && destination.exists())
27                 return false;
28
29             if (!destination.exists())
30                 destination.createNewFile();
31
32             input = new FileInputStream(source);
33             output = new FileOutputStream(destination);
34
35             // OMITTED: By using 'input' and 'output', read all bytes
36             // from 'source' and write them into 'destination'. At the
37             // end, 'source' and 'destination' contain the same data.
38
39             return true;
40         }
41         // OMITTED: In finally block, close all streams.
42     }
43 }
```

What will the copy method do when executed?

If a program calls the copy method with arguments such that source exists, destination may or may not exist (but destination's parent directory exists), and overwrite = false, which one statement is correct?

- No existing file is overwritten.
- If the destination file exists, an exception is thrown and no data is overwritten.
- If the destination file exists, the method fails to prevent overwriting the existing destination file. However, it is possible to implement a method such that the file is not overwritten.
- An implementation that guarantees existing files will not be overwritten is impossible in Java.
- None of the above.

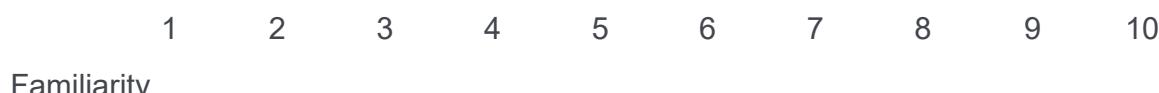
How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)



How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (**1**=Not clear at all; **10**=Very clear)



Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were unknown to you?

- 1
- 2
- 3
- 4+

Did you need to review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones?

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)



J50

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SCENARIO

You are asked to review a utility method written for a web application. The method, `setDate`, changes the date of the server. takes a String as the new date ("dd-mm-yyyy" format), attempts to change the date of the server, and returns true if it succeeded, and false otherwise.. Consider the snippet of code below (assuming the code runs on a Windows operating system) and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed
02 public final class SystemUtils {
03     public static boolean setDate (String date)
04         throws Exception {
05     return run("DATE " + date);
06 }
07
08     private static boolean run (String cmd)
09         throws Exception {
10     Process process = Runtime.getRuntime().exec("CMD /C " + cmd);
11     int exit = process.waitFor();
12
13     if (exit == 0)
14         return true;
15     else
16         return false;
17 }
18 }
```

What will the setDate method do when executed?

If a program calls the setDate method with an arbitrary String value as the new date, which one statement is correct?

- If the given String value does not conform to the “dd-mm-yyyy” format, an exception is thrown.
- The setDate method cannot change the date.
- The method might do more than changing the date.
- The return value of the waitFor method is not interpreted correctly (lines 14~17).
- The web application will crash.

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)

1 2 3 4 5 6 7 8 9 10

Confidence

How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)

1 2 3 4 5 6 7 8 9 10

Difficulty

How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)

1 2 3 4 5 6 7 8 9 10

Familiarity

How **clear** was this scenario? (1=Not clear at all; 10=Very clear)

1 2 3 4 5 6 7 8 9 10

Clarity

Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)



J22

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SCENARIO

You are developing a secure texting system. The software requirement for this system is to encrypt text messages before transferring them over network. The encrypt method takes three arguments: String alg (an encryption algorithm), Key key (a cryptographic key used for encryption), String text (a string value to be encrypted), and returns a byte array representing the ciphertext of the original (plain) text. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class CryptoUtils {
03     public static byte[] encrypt (String alg, Key key, String text)
04         throws GeneralSecurityException {
05
06     // Create a cipher
07     Cipher cipher = Cipher.getInstance(alg);
08     cipher.init(Cipher.ENCRYPT_MODE, key);
09
10    // Encrypt the data
11    byte[] bytes = text.getBytes();
12    byte[] output = new byte[cipher.getOutputSize(bytes.length)];
13    cipher.update(bytes, 0, bytes.length, output, 0);
14    cipher.doFinal(output);
15
16    return output;
17 }
18 }
```

What will the encrypt method do when executed?

If the encrypt method gets called with a valid algorithm and valid key and a non empty string, which one statement is correct?

- Depending on the key, the encrypt method may encrypt the text correctly.
- Depending on the algorithm, the encrypt method may encrypt the text correctly.
- The encrypt method never encrypts the text correctly.
- The encrypt method always encrypts the text correctly.
- The encrypt method will lead to a crash in the program where it is invoked.

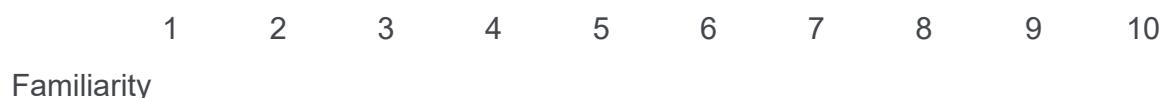
How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)



How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (1=Not clear at all; 10=Very clear)



Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

(Text area for notes)

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

(Text area for links)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

Fatigue

JX12

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SCENARIO

You are developing a secure library for compression/decompression operations. All methods in the library require that the size of the original file (uncompressed) can be determined and beat most 100MB, otherwise the library's methods throw an exception. The decompress method takes a String value as the path of a zip file, and a String value as the path of destination directory, and decompresses the zip file into the given directory. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute and there is no IOException

```
01 // OMITTED: Import whatever is needed.
02 public final class ZipUtils {
03     private static final int BUFFER = 0x1000; // 4KB
04     private static final int MAX_FILE_SIZE = 0x6400000; // 100MB
05
06     public static void decompress (String path, String directory)
07         throws IOException {
08         FileInputStream fis = new FileInputStream(path);
09         ZipInputStream zis = new ZipInputStream(fis);
10         try {
11             ZipEntry entry;
12             while ((entry = zis.getNextEntry()) != null) {
13                 if (entry.getSize() < 0)
14                     throw new IllegalStateException("Size of file cannot be
determined") ;
15                 if (entry.getSize() > MAX_FILE_SIZE)
16                     throw new IllegalStateException("File is too large." ) ;
17
18                 // OMITTED: Store the "entry" in the "directory"
19             }
20         }
21     }
22     finally {
23         //OMITTED: close the streams
24     }
25 }
26 }
```

What does the decompress method do when executed?

What will happen if the decompress method is called given a zip file containing an entry (named big.txt) larger than 100MB?

- big.txt won't be decompressed and the method will throw an exception.
- big.txt may or may not be decompressed.
- big.txt will definitely be decompressed.
- The program will crash after the invocation of the decompress method.
- None of the above.

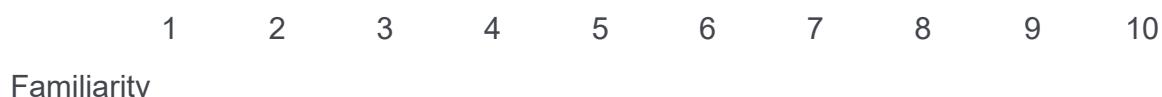
How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)



How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (1=Not clear at all; 10=Very clear)



Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

A large, empty rectangular box with a thin gray border, intended for the respondent to type their answer.

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)

1 2 3 4 5 6 7 8 9 10

Fatigue

JX02

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SCENARIO

You are developing a library for file operations (e.g., copy, move). For the move operation, you write a static method that takes three arguments: `File source` (the path of an existing file), `File destination` (the path of destination file with an existing parent directory), `boolean overwrite` (whether the `move` method should overwrite the existing destination file), and returns a boolean: `true` if the operation succeeded, `false` otherwise. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed
02 public final class FileUtils {
03     public static boolean move (File source, File destination,
04         boolean overwrite) {
05         if (overwrite) {
06             if (destination.exists())
07                 destination.delete();
08             return source.renameTo(destination);
09         }
10         else if (!destination.exists()) {
11             return source.renameTo(destination);
12         }
13         else {
14             return false;
15         }
16     }
17 }
```

What will the `move` method do when executed?

If a program calls the `move` method with arguments such that source exists, destination may or may not exist (but the destination's parent directory exists), and `overwrite` is `true`, which one statement is correct?

- If the move method returns true, the source file is moved. Further, if the destination file existed, it has been overwritten.
- If the destination file existed, it has not been overwritten: the source file is not moved, even if the move method returns true.
- If the destination file exists, an exception is thrown and no data is overwritten.
- The move operation may fail, no matter what the move method returns.
- None of the above.

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)



How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (**1**=Not clear at all; **10**=Very clear)



Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)



J96

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SCENARIO

Many applications need to write data into temporary files. In some cases these files contain sensitive information and, therefore, must be deleted before the application terminates. Consider such an application that writes sensitive data into a temporary file and deletes this file when it finishes processing it. The snippet of code below shows the implementation of the `processData` method. This method receives data as an array of bytes and processes it. Since the data (in both original or processed form) is sensitive, after the application exits, the temporary files must be deleted. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.  
02 public static class DataProcessingUtils {  
03     public static byte[] processData (byte[] data)  
04         throws IOException {  
05             //OMITTED: prepare 'data' for processing  
06  
07             Path file = Files.createTempFile("file", ".tmp");  
08             Files.write(file, data, StandardOpenOption.WRITE,  
09             StandardOpenOption.DELETE_ON_CLOSE);  
10  
11             //OMITTED: continue processing 'data'  
12             //OMITTED: return the result of processing  
13     }  
14 }
```

What will the method processFile do when executed?

If the JVM crashes after the execution of the processData method is completed, which one of the following is true?

- The temporary file will be deleted when the program crashes
- An exception will be thrown and the program will print “Error in the processFile method”.
- The temporary file will not be deleted.
- The temporary file may or may not be deleted.
- The temporary file will only be deleted when the garbage collector runs.

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)



How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (1=Not clear at all; 10=Very clear)



Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)



J12

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SCENARIO

You are developing a secure library for compression/decompression operations. All methods in the library require that the size of the original file (uncompressed) is at most 100MB, otherwise they throw an exception. The decompress method takes a String value as the path of a zip file, and a String value as the path of destination directory, and decompresses the zip file into the given directory. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute and there is no IOException.

```
01 // OMITTED: Import whatever is needed.
02 public final class ZipUtils {
03     private static final int BUFFER = 0x1000; // 4KB
04     private static final int MAX_FILE_SIZE = 0x6400000; // 100MB
05
06     public static void decompress (String path, String directory)
07         throws IOException {
08         FileInputStream fis = new FileInputStream(path);
09         ZipInputStream zis = new ZipInputStream(fis);
10         try {
11             ZipEntry entry;
12             while ((entry = zis.getNextEntry()) != null) {
13                 if (entry.getSize() > MAX_FILE_SIZE)
14                     throw new IllegalStateException("File is too large." );
15
16                 // OMITTED: Store the "entry" in the "directory"
17             }
18         }
19         finally {
20             //OMITTED: close the streams
21         }
22     }
23 }
```

What does the decompress method do when executed?

What will happen if the decompress method is called given a zip file containing an entry (named `big.txt`) larger than 100MB?

- big.txt won't be decompressed and the method will throw an exception.
- big.txt may or may not be decompressed.
- big.txt will definitely be decompressed.
- The program will crash after the invocation of the decompress method.
- None of the above.

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)



How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (1=Not clear at all; 10=Very clear)



Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)



JX24

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SCENARIO

You are developing a secure texting system. Text messages must be encrypted before being transferred over the network. The `encrypt` method takes two arguments: `text`, a String value to be encrypted, and `cipher`, a properly initialized Cipher object to process the encryption. The method returns a byte array representing the ciphertext of the original (plain) text. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class CryptoUtils {
03     public static byte[] encrypt (Cipher cipher, String text)
04         throws IOException {
05     ByteArrayOutputStream bytes = new ByteArrayOutputStream();
06     InputStream input = new ByteArrayInputStream(text.getBytes());
07     OutputStream processor = new CipherOutputStream(bytes, cipher);
08
09     // IOUtils.copy(input, processor): Reads all bytes from
10     // 'input' stream and writes them to 'processor' stream.
11     IOUtils.copy(input, processor);
12
13     processor.close();
14     return bytes.toByteArray();
15 }
16 }
```

What will the encrypt method do when executed?

Which one statement is correct if the encrypt method gets called to encrypt an arbitrary (non-null, non-empty) text with an arbitrary (properly initialized) Cipher object?

- The method always encrypts the text correctly.
- The method never encrypts the text correctly, and it throws an exception.
- The method never encrypts the text correctly, but it does not throw an exception.
- Depending on the cipher object, the method may encrypt the text correctly.
- None of the above.

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)

1 2 3 4 5 6 7 8 9 10



How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (1=Not clear at all; 10=Very clear)



Did you find an aspect of the scenario confusing? If so, please describe what you found confusing?

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (**1**=Not fatigued at all; **10**=Very fatigued)



J60

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SCENARIO

The Lightweight Directory Access Protocol (LDAP) is a protocol for accessing and maintaining distributed directory information services over an IP network. It allows an application to remotely perform operations, such as searching and modifying records in directories (directory servers). A common usage of LDAP is to provide single-sign-on (SSO) service where one user password is shared between many services.

You are developing an application that authenticates clients using the SSO service provided by the directory server of a company network. To perform the authentication, the authenticate method takes three `String` arguments: (1) `base`, the basename in the directory server, (2) `user`, the name of the account being authenticated, and (3) `passwd`, the password of the account. The method returns true if there is one, and only one, LDAP entry with the same credential information, and false otherwise. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed
02 public final class LdapAuthenticationProvider {
03     private static final Hashtable<String, Object> environment;
04
05     // OMITTED: Initialize the 'environment' field
06     // properly in the 'static' block of the class.
07
08     public static boolean authenticate (String base,
09         String user, String passwd) {
10         DirContext context;
11         try {
12             // A SearchControls object controls the search operation.
13             SearchControls sc = new SearchControls();
14             // OMITTED: Initialize 'sc' with the required parameters.
15
16             // The following query is used for authentication.
17             String qry = "(&(sn=" + user + ")(passwd=" + passwd + "))";
18
19             // This is the context in which you perform the query.
20             context = new InitialDirContext(environment);
21             NamingEnumeration<?> enmr = context.search(base, qry, sc);
22
23             // If there is more than one entry the authentication fails.
24             int count = 0;
25             while (enmr.hasMore() && enmr.next() != null)
26                 if (++count > 1) break;
27
28             return count == 1;
29         }
30         // OMITTED: Handle exceptions properly.
31         // OMITTED: In finally block, close the context.
32     }
33 }
```

What will the authenticate method do when executed?

Assuming that the environment field is properly initialized, and the directory server contains only two LDAP entries in the basename “dc=example,dc=com” with the following LDAP attributes (of type String): LDAP Entry #1: sn = "developer", passwd = "12345678" LDAP Entry #2: sn = "administrator", passwd = "Se34*a=d!", which one statement is correct if the authenticate method gets called as: authenticate("dc=example,dc=com", "administrator", "Se*");

- The method returns false.
- The method returns true.
- The method throws a RuntimeException exception.
- The method throws a NamingException exception.
- None of the above.

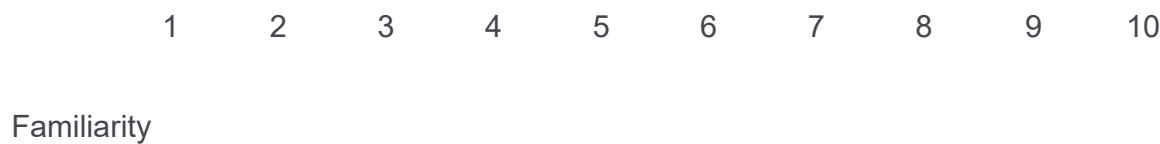
How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)



How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (1=Not clear at all; 10=Very clear)



1 2 3 4 5 6 7 8 9 10

Clarity

Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)



J57

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SCENARIO

You are developing a web application requiring authentication and authorization. The persistent store used for credential information (usernames and passwords) is a SQL database. The database has a table called “users” with three columns: “username” (the primary key), “password”, and “roles”. You are asked to write a helper method to get a username (a String value) and return its record containing roles information to the caller.

Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.  
02 public final class DbUtils {  
03     public static ResultSet getUser (String username)  
04         throws SQLException {  
05         String sql = "SELECT * FROM users WHERE username = '"  
06             + username.toLowerCase() + "'";  
07  
08         // Get a connection from the connection pool:  
09         Connection conn = DbUtils.getConnectionPool().getConnection();  
10         PreparedStatement stmt = conn.prepareStatement(sql);  
11         return stmt.executeQuery();  
12     }  
13 }
```

What will the getUser method do when executed?

If one calls the getUser method with an arbitrary `String` value given as `username`, which one statement is correct?

- The method reads and returns the roles field.
- The method may read and return the `username`, `roles`, and `password` fields.
- The method may read and return information from all users.
- The method may read and write information from all users.
- None of the above.

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)



How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (1=Not clear at all; 10=Very clear)



Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2

3 4+

Did you review any additional resources when working on this scenario?

 Yes No

If yes, which ones? (Please paste the links, if any)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)



J02

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SCENARIO

You are developing a library for file operations (e.g., copy, move). For the move operation, you write a static method that takes three arguments: `File source` (the path of an existing file), `File destination` (the path of

destination file with an existing parent directory), boolean overwrite (whether the move method should overwrite the existing destination file), and returns a boolean: true if the operation succeeded, false otherwise. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed
02 public final class FileUtils {
03     public static boolean move (File source, File destination,
04         boolean overwrite) {
05         if (overwrite) {
06             if (destination.exists())
07                 destination.delete(); // You can assume the deletion
08             succeeds.
09             source.renameTo(destination);
10             return true;
11         }
12         else if (!destination.exists()) {
13             source.renameTo(destination);
14             return true;
15         }
16         else {
17             return false;
18         }
19     }
}
```

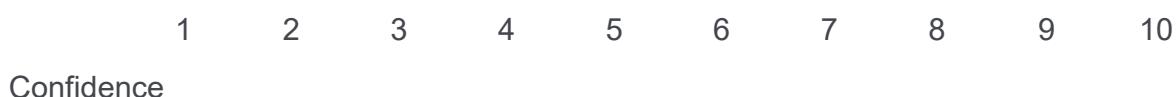
What will the move method do when executed?

If a program calls the move method with arguments such that source exists, destination may or may not exist (but the destination's parent directory exists), and overwrite is true, which one statement is correct?

- If the move method returns true, the source file is moved. Further, if the destination file existed, it has been overwritten.

- If the destination file existed, it has not been overwritten: the source file is not moved, even if the move method returns true.
- If the destination file exists, an exception is thrown and no data is overwritten.
- The move operation may fail, no matter what the move method returns.
- None of the above.

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)



How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (1=Not clear at all; 10=Very clear)



Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

(Redacted area)

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

(Redacted area)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)

1 2 3 4 5 6 7 8 9 10



J23

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SCENARIO

You are developing a secure texting system. The requirement asks to encrypt text messages before transferring them over network. The encrypt method takes three arguments: String alg (an encryption algorithm), Key key (a cryptographic key used for encryption), String text (a string value to be encrypted), and returns a byte array representing the ciphertext of the original (plain) text. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class CryptoUtils {
03     public static byte[] encrypt (String alg, Key key, String text)
04         throws GeneralSecurityException {
05     // Create a cipher
06     Cipher cipher = Cipher.getInstance(alg);
07     cipher.init(Cipher.ENCRYPT_MODE, key);
08
09     // Encrypt the data
10     byte[] input = text.getBytes();
11     byte[] output = new byte[input.length];
12
13     int length = cipher.update(input, 0, input.length, output, 0);
14     length += cipher.doFinal(output, length);
15     return output;
16 }
17 }
```

What will the encrypt method do when executed?

If the encrypt method gets called with a valid algorithm and valid key and a non empty string, which one statement is correct?

- Depending on the key, the encrypt method may encrypt the text correctly.
- Depending on the algorithm, the encrypt method may encrypt the text correctly.
- The encrypt method never encrypts the text correctly.
- The encrypt method always encrypts the text correctly.
- The encrypt method will lead to a crash in the program where it is invoked.

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)



How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (1=Not clear at all; 10=Very clear)



Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)



JX15

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SCENARIO

You are developing an application for managing files and directories. The application requires data on the average size of the files in each directory (excluding its subdirectories). The following code implements the `averageFileSize` method for this computation. The `averageFileSize` method takes one argument `path` (a `String` representing the path of a directory or file) and calculates and returns the average size of files in the given path if the given path is a directory, or returns the size of the file if the given path is a file. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class DirectoryUtils {
03     public static long averageFileSize (String path) {
04         // OMITTED: Acquire a FileLock object to prevent other
05         // processes from changing the path content while calculating
06         // the average file size. Assume nothing goes wrong here.
07
08         int count = 0;
09         long total = 0;
10         File file = new File(path);
11         if (file.isDirectory()) {
12             File[] files = file.listFiles();
13             if (files != null) {
14                 for (File child : files)
15                     if (child.isFile()) {
16                         count++;
17                         total += child.length();
18                     }
19             }
20         }
21         else if (file.isFile()) {
22             total = file.length();
23         }
24
25         // OMITTED: Release properly the FileLock object
26         // acquired at the beginning of the method.
27
28         if (count != 0)
29             return (total / count);
30         else
31             return total;
32     }
33 }
```

What will the averageFileSize method do when executed?

Which one statement is correct if the `averageFileSize` method gets called with a non-null, non-empty path as its argument?

- The method always returns an integer value (of type long).
- The method throws an exception on line 12, in case of any failure while getting the list of the directory content.
- The method throws an exception on lines 16 or 20, in case of any failure while reading the size of the file.
- The method throws an exception on a line other than 12, 16, or 20, in case of any failure while getting the list of the directory content.
- None of the above.

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)



How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (1=Not clear at all; 10=Very clear)



Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you need to review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)



J11

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SCENARIO

Consider an application that writes some information of its users to a file when users log in to the system. The application has one (and only one) “user information manager” (an object of type UserInfoFileManager) that handles creation and deletion of the file containing user information. As the file contains sensitive information, it must be deleted when the application terminates. In the following implementation of the class, the file is created when an instance of the class is created (in the constructor) and is deleted in the `finalize` method (which is to be called by the garbage collector on the “user information manager” when garbage collection determines that there are no more references to it.). Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class UserInfoFileManager {
03     private final File file;
04
05     /**
06      * Default constructor, initialize the "file" member
07      */
08     public UserInfoFileManager () {
09         file = new File("users.info");
10     }
11
12     /**
13      * This method writes the given information into the file.
14      * @param information the information to be written
15      * @throws IOException IOException thrown during writing
16      */
17     public final void write (String information)
18         throws IOException {
19         try (FileOutputStream output = new FileOutputStream(file)) {
20             output.write(information.getBytes());
21         }
22     }
23
24     // Delete the file during the object finalization
25     public void finalize () throws Throwable {
26         file.delete();
27         super.finalize();
28     }
29 }
```

What will happen when an instance of the class is created and then destroyed?

Considering the file pointed by the `file` member, and assuming that the application is the only process having access to the file, which one statement is correct?

- The file might be deleted (via the `finalize` method call) while the application is writing to it (via the `write` method call).
- The file is always deleted when the application terminates.

- The file is never deleted.
- It is not possible to do I/O operations in the finalize method.
- None of the above.

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)



How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (1=Not clear at all; 10=Very clear)



Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

(Redacted area)

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

(Redacted area)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

Fatigue

JX10

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SCENARIO

You are developing a library for common I/O operations. One of the methods of this library, `readAllBytes`, takes one argument: `InputStream input` (the stream to be read), reads the stream content, and returns the result as a byte array. The snippet of code below is an implementation of the `readAllBytes` method and its test case. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class IOUtils {
03     private static final int BUFFER_SIZE = 1024;
04
05     public static byte[] readAllBytes (InputStream input)
06         throws IOException {
07         ByteArrayOutputStream bytes;
08         bytes = new ByteArrayOutputStream(BUFFER_SIZE);
09
10         byte[] buffer = new byte[BUFFER_SIZE];
11         int length = 0;
12         while ((length = input.read(buffer)) != -1)
13             bytes.write(buffer, 0, length);
14
15         return bytes.toByteArray();
16     }
17
18     @Test
19     public static void testReadAllBytes () throws IOException {
20         byte[] sample = ...; // A byte array, not null, not empty;
21         InputStream stream = new ByteArrayInputStream(sample);
22         byte[] result = readAllBytes(stream);
23         assert Arrays.equals(sample, result);
24     }
25 }
```

What will the readAllBytes method do when executed?

Suppose that testReadAllBytes is executed with a non-null, non-empty array as the sample variable? (Assume there are no IO exceptions while the code is executed.) Which one statement is correct?

- The readAllBytes method always passes the test.
- The readAllBytes method never passes the test.

- The readAllBytes method is implemented correctly, but it may not pass the test.
- The readAllBytes method is implemented incorrectly, but it may pass the test.
- None of the above

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)



How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (1=Not clear at all; 10=Very clear)



Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

(Text area)

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

(Text area)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)

1 2 3 4 5 6 7 8 9 10



J51

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SCENARIO

You are developing a web application that runs on the Linux OS and that provides server administration functionalities (e.g. changing the hostname of server). Since there's no built-in feature in Java to change the hostname of machine, you have to use a Linux command to do so. The `setHostname` method takes a `String` as the new hostname, attempts to change the hostname of the server, and returns true if it succeeded, and false otherwise.. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed
02 public final class SystemUtils {
03     public static boolean setHostname (String hostname)
04         throws Exception {
05     String cmd = "hostname '" + hostname + "'";
06     ProcessBuilder builder = new ProcessBuilder("sh", "-c", cmd);
07     Process process = builder.start();
08     int exit = process.waitFor();
09
10     if (exit == 0)
11         return true;
12     else
13         return false;
14 }
15 }
```

What will the `setHostname` method do when executed?

If a program calls the `setHostname` method as `setHostname("'$shutdown'")`, which one statement is correct?

- setHostname throws an exception due to invalid character in the argument.
- setHostname fails and returns false because of the invalid character in the argument.
- setHostname sets the hostname of the server to “shutdown”.
- setHostname sets the hostname of the server to “0”.
- None of the above.

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)

1 2 3 4 5 6 7 8 9 10

Confidence

How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)

1 2 3 4 5 6 7 8 9 10

Difficulty

How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)

1 2 3 4 5 6 7 8 9 10

Familiarity

How **clear** was this scenario? (1=Not clear at all; 10=Very clear)



Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)



J86

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SCENARIO

You are developing a system which deals with lots of numbers. You have a utility class which helps with formatting of numbers. The `format` method takes a `String input`, and inserts a record into the log file, if the `input` is not a number. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.  
02 public final class NumberUtils {  
03     public static void format (String input)  
04         throws Exception {  
05     try{  
06         int value = Integer.parseInt(input);  
07     }  
08     catch(NumberFormatException e){  
09         log.info("Failed to parse input: " + input);  
10     }  
11  
12     // OMITTED: Further processing.  
13     // OMITTED: Close all resources properly.  
14 }  
15 }  
16  
17
```

What will the `format` method do when executed?

If the `format` method gets called, which one statement is correct?

- It parses all the inputs successfully to an integer value and does not log anything.
- It only logs the inputs for which the `parseInt` method throws `NumberFormatException`.
- Depending on the value of the input, the method may log some other messages as well.
- It logs at least one message for every execution.
- None of the above.

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)



How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (1=Not clear at all; 10=Very clear)



Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)



J93

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SCENARIO

Many applications need to write data into temporary files. In some cases these files contain sensitive information and, therefore, must be deleted before the application terminates. Consider such an application that writes sensitive data into a temporary file and deletes this file when it finishes processing it. The snippet of code below represents part of a simplified version of this application. The `processFile` method is called to create the temporary file, and the `sysSafeExit` method when the program ends normally. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public static class ProcessTempFile {
03     /**
04      * This method creates a temporary file and calls deleteOnExit
05      * to delete the file on Java JVM exit. The data that has to be
06      * written into the temporary file is passed as a String to the
07      * processFile method.
08     */
09     public static void processFile (String data)
10         throws IOException {
11         File file = new File("temp.tmp");
12         file.deleteOnExit();
13         try (FileOutputStream output = new FileOutputStream(file)) {
14             output.write(data.getBytes());
15             //OMITTED: Other file processing
16         }
17         Catch (Exception e) {
18             System.out.println("Error in the processFile method");
19         }
20     }
21
22     public void sysSafeExit() {
23         //OMITTED: Program safely terminates;
24     }
25 }
```

What will the method `processFile` do when executed?

Suppose the JVM crashes after the method `processFile` is executed, but before method the `sysSafeExit` is called. Which one of the following is true?

- The temporary file will be deleted when the program crashes, because the `deleteOnExit` method is called.
- An exception will be thrown and the program will print “Error in the `processFile` method” before crashing.
- The temporary file will not be deleted.
- The temporary file may or may not be deleted.
- The temporary file will only be deleted when the garbage collector runs.

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)



How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (**1**=Not clear at all; **10**=Very clear)



Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

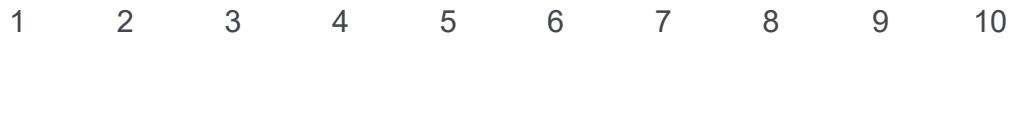
- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)



JX23

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SCENARIO

You are developing a secure texting system. The requirement asks to encrypt text messages before transferring them over network. The encrypt method takes three arguments: String `alg` (an encryption algorithm), Key `key` (a cryptographic key used for encryption), String `text` (a string value to be encrypted), and returns a byte array representing the ciphertext of the original (plain) text. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.  
02 public final class CryptoUtils {  
03     public static byte[] encrypt (String alg, Key key, String text)  
04         throws GeneralSecurityException {  
05         // Create a cipher  
06         Cipher cipher = Cipher.getInstance(alg);  
07         cipher.init(Cipher.ENCRYPT_MODE, key);  
08  
09         // Encrypt the data  
10         byte[] input = text.getBytes();  
11         byte[] output = new byte[cipher.getOutputSize(input.length)];  
12  
13         int length = cipher.update(input, 0, input.length, output, 0);  
14         length += cipher.doFinal(output, length);  
15         return output;  
16     }  
17 }
```

What will the encrypt method do when executed?

If the encrypt method gets called with a valid algorithm and valid key and a non empty string, which one statement is correct?

- Depending on the key, the encrypt method may encrypt the text correctly.
- Depending on the algorithm, the encrypt method may encrypt the text correctly.
- The encrypt method never encrypts the text correctly.
- The encrypt method always encrypts the text correctly.
- The encrypt method will lead to a crash in the program where it is invoked.

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)



How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (1=Not clear at all; 10=Very clear)



Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)



JX01

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SCENARIO

You are developing a library for file operations (e.g., copy, move). For the copy operation, you write a method that takes three arguments: a source file's path, a destination file's path, and a boolean flag indicating if the destination file should be overwritten. The following is an implementation of the copy method. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class FileUtils {
03     /**
04      * This method copies the contents of the specified source file
05      * to the specified destination file. The source file and the
06      * directory holding the destination file have to exist.
07      * If 'overwrite' argument is true, then the method will
08      * overwrite the destination file if it exists.
09      *
10     * @param source
11     *         the path to an existing file
12     * @param destination
13     *         the path of a destination file
14     * @param overwrite
15     *         whether the copy method should overwrite existing
16     *         destination file
17     * @return true, if the operation succeeded, otherwise false
18     * @throws NullPointerException if source or destination is null
19     *         IOException if an I/O error occurs
20     */
21     public static boolean copy (File source, File destination,
22         boolean overwrite) throws IOException {
23         InputStream input = null;
24         OutputStream output = null;
25         try {
26             if (!overwrite && destination.exists())
27                 return false;
28
29             if (destination.createNewFile() || overwrite) {
30                 input = new FileInputStream(source);
31                 output = new FileOutputStream(destination);
32
33                 // OMITTED: By using 'input' and 'output', read all bytes
34                 // from 'source' and write them into 'destination'. At the
35                 // end, 'source' and 'destination' contain the same data.
36
37                 return true;
38             }
39             return false;
40         }
41         // OMITTED: In finally block, close all open streams;
42     }
43 }
```

What will the copy method do when executed?

If a program calls the copy method with arguments such that source exists, destination may or may not exist (but destination's parent directory exists), and overwrite = false, which one statement is correct?

- No existing file is overwritten.
- If the destination file exists, an exception is thrown and no data is overwritten.
- If the destination file exists, the method fails to prevent overwriting the existing destination file. However, it is possible to implement a method such that the file is not overwritten.
- An implementation that guarantees existing files will not be overwritten is impossible in Java.
- None of the above.

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)

1 2 3 4 5 6 7 8 9 10

Confidence

How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)

1 2 3 4 5 6 7 8 9 10

Difficulty

How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)

1 2 3 4 5 6 7 8 9 10

Familiarity

How **clear** was this scenario? (**1**=Not clear at all; **10**=Very clear)



Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were unknown to you?

- 1
- 2
- 3
- 4+

Did you need to review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones?

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)



J24

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SCENARIO

You are developing a secure texting system. Text messages must be encrypted before being transferred over the network. The `encrypt` method takes two arguments: `text`, a String value to be encrypted, and `cipher`, a properly initialized Cipher object to process the encryption. The method returns a byte array representing the ciphertext of the original (plain) text. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class CryptoUtils {
03     public static byte[] encrypt (String text, Cipher cipher)
04         throws IOException {
05         byte[] bytes = text.getBytes();
06         try {
07             InputStream input = new ByteArrayInputStream(bytes);
08             ByteArrayOutputStream output = new ByteArrayOutputStream();
09             OutputStream proc = new CipherOutputStream(output, cipher)
10         } {
11             // The following statement reads all bytes from
12             // 'input' stream and writes them to 'proc' stream.
13             IOUtils.copy(input, proc);
14
15             // Return the ciphertext (as a byte array).
16             return output.toByteArray();
17         }
18     }
19 }
```

What will the encrypt method do when executed?

Which one statement is correct if the encrypt method gets called to encrypt an arbitrary (non-null, non-empty) text with an arbitrary (properly initialized) Cipher object?

- The method always encrypts the text correctly.
- The method never encrypts the text correctly, and it throws an exception.
- The method never encrypts the text correctly, but it does not throw an exception.
- Depending on the cipher object, the method may encrypt the text correctly.
- None of the above.

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)



How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (1=Not clear at all; 10=Very clear)



Did you find an aspect of the scenario confusing? If so, please describe what you found confusing?

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (**1**=Not fatigued at all; **10**=Very fatigued)



J65

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SCENARIO

You are developing an account-management service to be used for account registration and authentication. To register an account, a client has to provide a username and a password. According to the registration guidelines, a username can be any non-empty string. Note that a null string is considered an empty string. The username cannot appear in the password. The register method takes two arguments: `String user` (the username of the account), and `String pass` (the password of the account). After checking the validity of the username and password, if both are valid, the account is registered in the database. Otherwise, the method throws an `IllegalArgumentException`. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class AccountManager {
03     public static void register (String user, String pass) {
04         if (user == null || user.isEmpty())
05             throw new IllegalArgumentException("Bad Username!");
06         if (pass == null || pass.isEmpty())
07             throw new IllegalArgumentException("Bad Password!");
08
09         // Use regex to check the similarity.
10         Pattern pattern = Pattern.compile("(.*?)" + user);
11         boolean similar = pattern.matcher(pass).matches();
12
13         if (similar)
14             throw new IllegalArgumentException("Weak Password!");
15
16         // OMITTED: Continue to create the account in the database.
17     }
18 }
```

What will the register method do when executed?

Which one statement is correct if the register method gets called as:
`register("(a+)+", "aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa!");`

- The password is checked and the account is created.
- The method throws an `IllegalArgumentException` with “Bad Password!”
- The method throws an `IllegalArgumentException` with “Weak Password!”
- The method throws a `PatternSyntaxException`.
- None of the above.

How **confident** are you that you correctly solved this scenario? (1=Not confident at all; 10=Very confident)



How **difficult** was this scenario? (1=Not difficult at all; 10=Very difficult)



How **familiar** were you with the functions in this scenario? (1=Not familiar at all; 10=Very familiar)



How **clear** was this scenario? (1=Not clear at all; 10=Very clear)



Did you find any aspect of the scenario confusing? If so, please describe what you found confusing.

Were there functions in this scenario that were unfamiliar to you?

- Yes
- No

How many functions in this scenario were new to you?

- 1
- 2
- 3
- 4+

Did you review any additional resources when working on this scenario?

- Yes
- No

If yes, which ones? (Please paste the links, if any)

How cognitively drained and/or **fatigued** are you after completion of **this** coding snippet? (1=Not fatigued at all; 10=Very fatigued)



Overall Fatigue

How cognitively drained and/or **fatigued** are you after completion of **the entire set** of coding snippets? (1=Not fatigued at all; 10=Very fatigued)



9-Demographic Question

Excellent job! You have now completed the first portion of the **Developer Code Perception Study**.

The following section will ask you basic demographic questions as well as some questions regarding your background and experience with computer programming/developing.

Please enter your date of birth (MM/DD/YYYY)

What is your gender?

- Male
- Female

What is your age?

Is English your first language?

- Yes
- No

If not, what is your first language?

Are you bilingual?

- Yes
- No

What is the highest level of education you have completed?

- Some High school, but did not graduate
- High School Graduate or GED
- Some college
- Associate's/2-year degree
- Bachelor's/4-year degree
- Some Graduate School
- Graduate-level degree

What is/was your major area of study? (if a current or former student)

- Computer Science
- Computer Engineering
- Mathematics
- Statistics
- Other

Please enter your major of study

What is your current employment status?

- Employed
- Unemployed
- Student

Have you ever worked as a programmer(Internship/Fulltime)?

- Yes
- No

Average yearly income?

- <\$40,000
- \$40,000 - \$70,000
- \$71,000 - \$100,000
- \$101,000 - \$200,000
- >\$201,000

Are you Hispanic or Latino?

- No, not Hispanic or Latino
- Yes, Hispanic or Latino

Racial/Ethnic category?

- American Indian or Alaska Native
- Asian
- Black or African American
- Native Hawaiian or Other Pacific Islander

- White
- Other / Multi-racial

The following section will ask about your experience with computer programming, as well as your Internet usage habits.

How many years have you been programming/ developing? (please type just the number, no units)

Which of the following programming languages do you have a working knowledge of?
(Select all that apply)

- Java
- Python
- C / C++/ C#
- PHP
- Visual Basic .Net
- Javascript
- Other

How many years have you programmed in **Java**? (If you have used this language for less than one year, still type in 1)

How skilled are you at programming in **Java**? (1=Not very skilled; 10=Very skilled)



How many years have you programmed in **Python**? (If you have used this language for less than one year, still type in 1)

How skilled are you at programming in **Python**? (1=Not very skilled; 10=Very skilled)



How many years have you programmed in **C++/C#**? (If you have used this language for less than one year, still type in 1)

How skilled are you at programming in **C++/C#**? (1=Not very skilled; 10=Very skilled)



How many years have you programmed in **PHP**? (If you have used this language for less than one year, still type in 1)

How skilled are you at programming in **PHP**? (1=Not very skilled; 10=Very skilled)



How many years have you programmed in **Visual Basic.Net**? (If you have used this language for less than one year, still type in 1)

How skilled are you at programming in **Visual Basic.Net**? (1=Not very skilled; 10=Very skilled)



How many years have you programmed in **Javascript**? (If you have used this language for less than one year, still type in 1)

How skilled are you at programming in **Javascript**? (1=Not very skilled; 10=Very skilled)



What is the Other language you programmed in?

How many years have you programmed in **Other languages**? (If you have used this language for less than one year, still type in 1)

How skilled are you at programming in **Other languages**? (1=Not very skilled; 10=Very skilled)



What was your primary method for learning how to program?

- Formal Education (e.g. educational institution, seminars)
- Self-taught methods (e.g. online videos, peers, books)
- Both Formal Education and Self-taught methods

Which of the following do you utilize when writing code?

- Integrated Development Environment, IDE (e.g., Eclipse or NetBeans)
- Text editor (e.g., VIM, Emacs etc)

What Internet browser do you most frequently use?

- Internet Explorer
- Chrome
- Firefox
- Safari
- Other

How many hours per week do you use the Internet? (please type just the number of hours, no units)

What do you use the Internet for? (For example: browsing, checking email, school, media, etc)

10-Technology Java Puzzle

The following section will ask you questions regarding your knowledge and experience with different programming concepts and technologies.

To what extent are you knowledgeable about the following concepts and technologies?
(1=Not knowledgeable at all; 10=Very knowledgeable)

1 2 3 4 5 6 7 8 9 10

SQL/MySQL

YAML

XML

Serialization/Deserialization

SSL/TLS

Cryptography

To what extent are you knowledgeable about the following concepts and technologies?
(1=Not knowledgeable at all; 10=Very knowledgeable)

1 2 3 4 5 6 7 8 9 10

File Compression
(e.g., tar, zip)

Access Control

Temporary File
Creation

HTTP/HTTPS

On-disk Mailboxes

To what extent are you knowledgeable about the following concepts and technologies? **(1=Not knowledgeable at all; 10=Very knowledgeable)**

1 2 3 4 5 6 7 8 9 10

1 2 3 4 5 6 7 8 9 10

Networking (e.g.,
sockets and pipes)

Creating and Writing
to Files

LDAP Programming

Multithreading

Regular Expressions

File Operations (e.g.,
creating and
deleting)

11-Transition

The remaining portion of the survey will present you with a variety of tasks measuring your personality and thinking process. We ask that you complete all of the tasks in one sitting. Because you have just completed an already demanding set of coding scenarios, we **strongly recommend** that you take a break at this point, and return to complete the survey **tomorrow**, to ensure best performance. Your position in the survey has been saved, so clicking on the **study link** found in the original email will return you to this page.

Once again, these tasks will take about **30 minutes** to complete. It is important that you do them while in an **environment with little to no distractions**.

When ready to proceed, please click on the “Next” button below.

12-Big Five Inventory

Here are a number of characteristics that may or may not apply to you. For example, "I see myself as someone who likes to spend time with others." Please fill in the bubble next to each statement to indicate the extent to which you agree or disagree with that statement.

I see myself as someone who...

	Disagree Strongly	Disagree a Little	Neither Agree nor Disagree	Agree a Little	Agree Strongly
Is talkative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tends to find fault with others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Does a thorough job	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is depressed, blue	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is original, comes up with new ideas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is reserved	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is helpful and unselfish with others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Can be somewhat careless	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Disagree Strongly	Disagree a Little	Neither Agree nor Disagree	Agree a Little	Agree Strongly
Is relaxed, handles stress well	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is curious about many different things	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is full of energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Starts quarrels with others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is a reliable worker	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Can be tense	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is ingenious, a deep thinker	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Generates a lot of enthusiasm	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Disagree Strongly	Disagree a Little	Neither Agree nor Disagree	Agree a Little	Agree Strongly
Has a forgiving nature	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tends to be disorganized	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Worries a lot	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Has an active imagination	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Tends to be quiet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is generally trusting	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Disagree Strongly	Disagree a Little	Neither Agree nor Disagree	Agree a Little	Agree Strongly
Tends to be lazy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is emotionally stable, not easily upset	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Disagree Strongly	Disagree a Little	Neither Agree nor Disagree	Agree a Little	Agree Strongly
Is inventive	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Has an assertive personality	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Can be cold and aloof	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Perseveres until the task is finished	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Can be moody	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Values artistic, aesthetic experiences	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is sometimes shy, inhibited	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is considerate and kind to almost everyone	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Disagree Strongly	Disagree a Little	Neither Agree nor Disagree	Agree a Little	Agree Strongly
Does things efficiently	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Remains calm in tense situations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Prefers work that is routine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is outgoing, sociable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is sometimes rude to others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Makes plans and follows through with them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gets nervous easily	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Likes to reflect, play with ideas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Disagree Strongly	Disagree a Little	Neither Agree nor Disagree	Agree a Little	Agree Strongly
Has few artistic interests	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Likes to cooperate with others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Is easily distracted	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



13-NIH Oral Symbols

Flash Setup

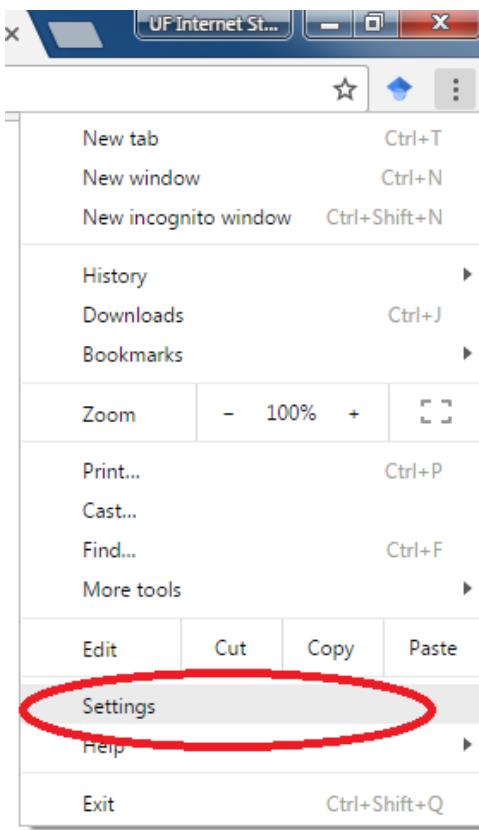
Due to recent updates to the **Chrome Web Browser** the default setting for running Flash has been set to "Ask first before allowing sites to run Flash". This setting will cause issues with the proper presentation of certain elements of the remaining portion of the survey and should be toggled to "Allow sites to run Flash". **Once you have completed the survey, please feel free to toggle the setting back to its recommended level.** Please follow the 6 easy steps below to temporarily update your Google Chrome Flash settings:

- 1.) Click the Chrome menu button



Google Search | I'm Feeling Lucky

- 2.) Navigate to Settings



3.) Click on "Show advanced settings"

Search
Set which search engine is used when searching from the omnibox.
Google ▾ Manage search engines...

People
UF Internet Study (current)
Enable Guest browsing
Let anyone add a person to Chrome
Add person... Edit... Remove... Import bookmarks and settings...

Default browser
Make Google Chrome the default browser
Google Chrome is not currently your default browser.
[Show advanced settings...](#)

4.) Under the heading **Privacy**, click on the button "Content settings.."

Privacy
Content settings... Clear browsing data...
Google Chrome may use web services to improve your browsing experience. You may optionally disable these services. [Learn more](#)

5.) Scroll down until you see the heading **Flash**, and select "Allow sites to run Flash"

Content settings

[Manage exceptions...](#)

JavaScript

Allow all sites to run JavaScript (recommended)
 Do not allow any site to run JavaScript
[Manage exceptions...](#)

Handlers

Allow sites to ask to become default handlers for protocols (recommended)
 Do not allow any site to handle protocols
[Manage handlers...](#)

Flash

Allow sites to run Flash
 Ask first before allowing sites to run Flash (recommended)
 Block sites from running Flash
[Manage exceptions...](#)

Pop-ups

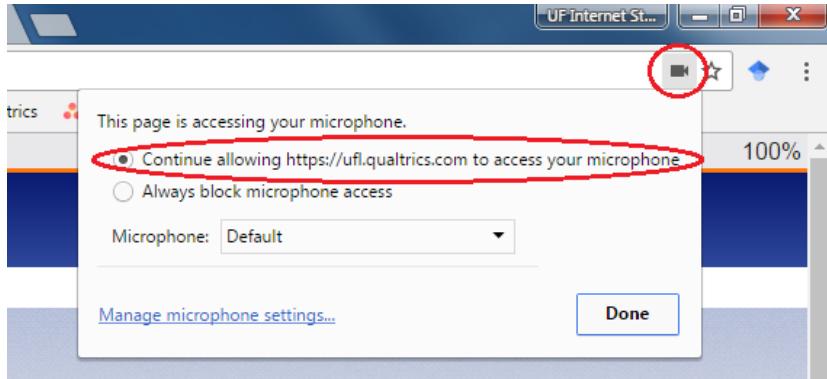
6.) Click Done

Throughout the next section, you will hear a variety of words and numbers. **Please do not use any paper, pencil, or other recording medium for the following tasks.**

Before we begin, we would like to ensure that you are able to hear the task audio clearly. You will hear a series of numbers. Please enter them in the text field below (**separated by commas and no spaces, e.g. 1,2,3,4**) in order to confirm the proper volume. Feel free to replay the recording to adjust the audio on your speakers/headphones. Click the “**Next**” button when you are done.

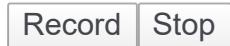
Next, we would like to ensure that your microphone is working correctly. In this task, you will find that some questions will require a **vocal answer**. Please follow the steps below to ensure that the microphone works fine and the audio is recorded successfully. You may need to refresh your page to activate the changes.

Chrome users:



Click on the "Record" button and speak. After clicking the "Stop" button, the recording will end.

Use the play button to hear your voice and ensure that the sound is clear. You can use this test multiple times.



Click "**Next**" when satisfied.

If your recording is **unsuccessful or in-audible**, please **pause** the survey and contact the lab at 352-273-2134 or psy-ebnerlab@psych.ufl.edu and someone will assist you with resolving the issue. Please do not continue the survey with audio issues, as this will not provide useful data to the study.

Please look at the symbols below. Each symbol is paired with a number.

Please click on "**Next**" to continue.

Now below there are symbols but no numbers. I would like you to tell us the number that goes with each symbol by typing the correct number into the field below each symbol.

Now try the rest of the row below for practice. Remember to type each number for the appropriate fields below (**separated by commas and no spaces, e.g. 1,2,3,4,5**)

—	И	□	↳	U	O	^	X	=
1	2	3	4	5	6	7	8	9

O	X	□	=	U	↳	—	^	И
---	---	---	---	---	---	---	---	---

Now when you progress to the full task, you will be **saying** the correct responses into your **microphone** instead of typing the numbers. This will be recorded and scored by our research team upon completion of this task. When you begin the task, you will see similar rows as you did in the practice set. We want you to work as quickly as you can without skipping any boxes or making mistakes. When you are finished with the first row, **move onto the next rows**. Continue until the screen goes blank. If you make a mistake, just say the correct answer and keep going.

Please remember to speak **loudly and clearly** into the microphone so that your responses are properly recorded. When the recording has begun, you will hear a "**ping**" sound to indicate that you should begin speaking. Are you ready?

Please click on "**Next**" to continue.

Start Test

You will now proceed to the final task as part of full completion of the **Developer Code Perception Study**.

Please click on the "**Next**" button to continue.

14-BTACT

For this next section, you will be presented with a series of tasks intended to measure your thinking process.

Please do not use any paper, pencil, or other recording medium for the following tasks.

Some of the questions will be easy for you, and some will be harder. We do not expect anyone to get all of these correct—just do the best that you can.

You are going to hear a list of 15 words. Listen carefully. When the list is finished, you are to repeat as many of the words as you can remember. It doesn't matter in what order you repeat them. Just try to remember as many as you can. You will hear each word only one time. You will have up to one and a half minutes (**90 seconds**).

Please press "**Play**" below to hear the audio. When the audio has finished, click the "**Next**" button to proceed to the next page where the recording for your responses will begin after **1 second**.

We suggest that you close your eyes while you are listening to the audio to help you concentrate.

NOTE: On the pages where your audio response is being recorded, **the page will automatically progress after the allotted time has finished.**

Please do not refresh/reload the page after the recording has begun.

Play

BEGIN.

On the next page, you are going to hear some strings of numbers, and when the **audio finishes**, we would like you to type them in backwards, in the reverse order from which you heard them. So if you hear “3,8”, you would type “8,3” (**separated by commas and no spaces**). The sets will get larger as they go.

Please remember NOT to use any paper, pencil, or other recording medium for the following tasks.

After typing each response, please click on the "**Next**" button to proceed.

Play

Play

Play

Play

Play

Play

Now you are going to be given a category and you will name things that belong in that category. For example, if the category was “**fruit**,” you could say things like “**peach**” or “**pear**.”

In a moment you will be given a *different* category. When you see “Begin,” you will name all the things from this new category you can think of, as fast as you can. You will have one minute (**60 seconds**) to do this.

When you proceed to the [next](#) page the recording will begin after **3 seconds**.

The new category is **Animals**... BEGIN.

In the next exercise you will hear a series of numbers that may get larger or smaller in value. At the end you will try to figure out what the next number would be. So if the numbers were 2, 4, 6, 8, 10, the next number would be **12**.

Please click on the buttons **A-E** (in alphabetical order) to listen to each recording in the sequence one after the other. You will not be able to replay the audio, but you may take as much time as you need in-between each number. At the end you will be asked what you think the next number would be. You will type your response into the available text field and then click the "[Next](#)" button to submit each response.

Please click the "[Next](#)" button to continue.

Let's try one for **practice**:

Numbers:

A	B	C	D
---	---	---	---

That is correct! The answer would be 10 as each number has decreased by 5.

Unfortunately that was incorrect. Let's try listening to the audio again.

Numbers:

A	B	C	D
---	---	---	---

That is correct! The answer would be 10 as each number has decreased by 5.

The answer should have been 10, as each number has decreased by 5.

(30,25,20,15...**10**)

There will be different patterns, and some of these will be harder than others, so just do the best that you can. If you are not sure of the answer, it is **okay** to guess.

Numbers:

A	B	C	D	E
---	---	---	---	---

The next set is....

Numbers:

A	B	C	D	E
---	---	---	---	---

The next set is....

Numbers:

A	B	C	D	E
---	---	---	---	---

The next set is....

Numbers:

A	B	C	D	E
---	---	---	---	---

The next set is....

Numbers:

A	B	C	D	E
---	---	---	---	---

Next, we would like to see how fast you can count backwards. When you are given the signal to begin, start counting backwards from 100 out loud, as fast as you can. So you will say 100, 99, 98 and so on.

When you proceed to the **next** page, the recording will begin in **1 second**. You will have half a minute (**30 seconds**). The task will automatically end when the time expires.

BEGIN.

Good, now one more question.

Do you remember the very first list of 15 words that you heard in the beginning? It was the very first task that you did.

We would like you to tell us as many of the words from that list as you can. You will have up to one minute (**60 seconds**) to do so.

When you proceed to the **next** page, the recording will begin after **1 second**.

BEGIN.

15-Debrief Introduction

The following section will present you with the **correct responses** to each of the programming scenarios that you have answered.

An explanation for **why** it was the best response will be provided for each answer.

JD21

SCENARIO

You are developing a secure texting system. Text messages must be encrypted before being transferred over the network. The encrypt method takes three arguments: alg, a String value indicating the encryption algorithm, key, a Key object to be used as the encryption key, and text, a String value to be encrypted. The method returns a byte array representing the ciphertext of the original (plain) text. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class CryptoUtils {
03     public static byte[] encrypt (String alg, Key key, String text)
04         throws GeneralSecurityException {
05     if (text == null)
06         return null;
07
08     if (text.isEmpty())
09         return new byte[0];
10
11     // Create a cipher
12     Cipher cipher = Cipher.getInstance(alg);
13     cipher.init(Cipher.ENCRYPT_MODE, key);
14
15     // Encrypt the data
16     byte[] encrypted = cipher.update(text.getBytes());
17     return encrypted;
18 }
19 }
```

Which one statement is correct if the encrypt method gets called to encrypt an arbitrary (non-null, non-empty) text with arbitrary (yet valid) algorithm and key object?

- A. The encrypt method always encrypts the text correctly.

- B. The encrypt method never encrypts the text correctly, and it throws an exception.
- C. The encrypt method never encrypts the text correctly, but it does not throw an exception.
- D. Depending on the encryption algorithm, the encrypt method may encrypt the text correctly.
- E. None of the above.

ANSWER

D.

According to the API documentation it's better to call the `doFinal` method at the end of processing of data. For some algorithms it is a must. The `doFinal` method is very similar to the `update` method in that it may also put out 0 or more bytes, depending on the encryption algorithm. Otherwise the encrypted data is not valid and may not be decrypted properly. Thus, even though the `encrypt` method does not throw any exception, the produced data (in this case ciphertext) is invalid and cannot be decrypted to the original text. Depending on the encryption algorithm, this code might work in some cases, though it is not generally the correct way of using cipher objects.

JDX57

SCENARIO

You are developing a web application requiring authentication and authorization. The persistent store used for credential information (usernames and passwords) is a SQL database. The database has a table called "users" with three columns: "username" (the primary key), "password", and "roles". You are asked to write a helper method to get a username (a String value) and return its record containing roles information to the caller. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.  
02 public class DbUtils {  
03     public static ResultSet getUser (String username)  
04         throws SQLException {  
05         String sql = "SELECT * FROM users WHERE username = ?";  
06  
07         // Get a connection from the connection pool:  
08         Connection conn = DbUtils.getConnectionPool().getConnection();  
09         PreparedStatement stmt = conn.prepareStatement(sql);  
10         stmt.setString(1, username);  
11         return stmt.executeQuery();  
12     }  
13 }
```

If one calls the getUser method with an arbitrary String value given as username, which one statement is correct?

- A. The method reads and returns the roles field.
- B. The method may read and return the username, roles, and password fields.
- C. The method may read and return information from all users.
- D. The method may read and write information from all users.
- E. None of the above.

ANSWER

A.

JD01

SCENARIO

You are developing a library for file operations (e.g., copy, move). For the copy operation, you write a method that takes three arguments: a source file's path, a destination file's path, and a boolean flag indicating if the destination file should be overwritten. The following is an implementation of the copy method. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class FileUtils {
03     /**
04      * This method copies the contents of the specified source file
05      * to the specified destination file. The source file and the
06      * directory holding the destination file have to exist.
07      * If 'overwrite' argument is true, then the method will
08      * overwrite the destination file if it exists.
09      *
10     * @param source
11     *         the path to an existing file
12     * @param destination
13     *         the path of a destination file
14     * @param overwrite
15     *         whether the copy method should overwrite existing
16     *         destination file
17     * @return true, if the operation succeeded, otherwise false
18     * @throws NullPointerException if source or destination is null
19     *         IOException if an I/O error occurs
20     */
21     public static boolean copy (File source, File destination,
22                               boolean overwrite) throws IOException {
23         InputStream input = null;
24         OutputStream output = null;
25         try {
26             if (!overwrite && destination.exists())
27                 return false;
28
29             if (!destination.exists())
30                 destination.createNewFile();
31
32             input = new FileInputStream(source);
33             output = new FileOutputStream(destination);
34
35             // OMITTED: By using 'input' and 'output', read all bytes
36             // from 'source' and write them into 'destination'. At the
37             // end, 'source' and 'destination' contain the same data.
38
39             return true;
40         }
41         // OMITTED: In finally block, close all streams.
42     }
43 }
```

What will the copy method do when executed?

If a program calls the copy method with arguments such that source exists, destination may or may not exist (but destination's parent directory exists), and overwrite = false, which one statement is correct?

- A. No existing file is overwritten.
- B. If the destination file exists, an exception is thrown and no data is overwritten.
- C. If the destination file exists, the method fails to prevent overwriting the existing destination file. However, it is possible to implement a method such that the file is not overwritten.
- D. An implementation that guarantees existing files will not be overwritten is impossible in Java.
- E. None of the above.

ANSWERS

1.) The method makes a copy of a file by copying its content to a new file, or by overwriting its content to an existing file, if `overwrite = true`.

2.) C.

In the implementation above, checking if the file exists and creating the file (lines 29 & 30) are not atomic. Since the code does not check the return value of the `createNewFile` method after the call (line 30), it is not clear if the file is newly created or if it existed before the call. So, there is a possibility that right after checking for the file's existence (line 29), but before creating the file (line 30), another process/thread creates a file with the same name. This means that the rest of the code is about to write data on an existing file, even though the `overwrite` flag is set to false.

JD50

SCENARIO

You are asked to review a utility method written for a web application. The method, `setDate`, changes the date of the server. takes a `String` as the new date ("dd-mm-yyyy" format), attempts to change the date of the server, and returns `true` if it succeeded, and `false` otherwise.. Consider the snippet of code below (assuming the code

runs on a Windows operating system) and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed
02 public final class SystemUtils {
03     public static boolean setDate (String date)
04         throws Exception {
05     return run("DATE " + date);
06 }
07
08     private static boolean run (String cmd)
09         throws Exception {
10     Process process = Runtime.getRuntime().exec("CMD /C " + cmd);
11     int exit = process.waitFor();
12
13     if (exit == 0)
14         return true;
15     else
16         return false;
17 }
18 }
```

If a program calls the setDate method with an arbitrary String value as the new date, which one statement is correct?

- A. If the given String value does not conform to the “dd-mm-yyyy” format, an exception is thrown.
- B. The setDate method cannot change the date.
- C. The method might do more than changing the date.
- D. The return value of the waitFor method is not interpreted correctly (lines 14~17).
- E. The web application will crash.

ANSWER

C.

The method above lets the argument be almost anything which makes it vulnerable to command injection attack. For example calling the setDate method with "10-12-2015 && shutdown /s" as the argument changes the date and then turns off the server. Either the argument has to be sanitized or its type should be Java Date class.

JD22

SCENARIO

You are developing a secure texting system. The software requirement for this system is to encrypt text messages before transferring them over network. The encrypt method takes three arguments: String alg (an encryption algorithm), Key key (a cryptographic key used for encryption), String text (a string value to be encrypted), and returns a byte array representing the ciphertext of the original (plain) text. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class CryptoUtils {
03     public static byte[] encrypt (String alg, Key key, String text)
04         throws GeneralSecurityException {
05
06     // Create a cipher
07     Cipher cipher = Cipher.getInstance(alg);
08     cipher.init(Cipher.ENCRYPT_MODE, key);
09
10    // Encrypt the data
11    byte[] bytes = text.getBytes();
12    byte[] output = new byte[cipher.getOutputSize(bytes.length)];
13    cipher.update(bytes, 0, bytes.length, output, 0);
14    cipher.doFinal(output);
15
16    return output;
17 }
18 }
```

If the encrypt method gets called with a valid algorithm and valid key and a non empty string, which one statement is correct?

- A. Depending on the key, the encrypt method may encrypt the text correctly.
- B. Depending on the algorithm, the encrypt method may encrypt the text correctly.
- C. The encrypt method never encrypts the text correctly.
- D. The encrypt method always encrypts the text correctly.
- E. The encrypt method will lead to a crash in the program where it is invoked.

ANSWER

B.

The code snippet, as is, does not encrypt the data properly. According to the API documentation the `doFinal(byte[] input)` method (called in the above code line #14) takes the argument as input data, not output. Thus the method `doFinal` does not do the finalization on the output, but it treats the argument as input data and encrypts it and returns the encrypted version of the argument. The correct usage of the method is to pass both the array of encrypted data and the offset returned by the previous call of the `update` method.

JDX12

SCENARIO

You are developing a secure library for compression/decompression operations. All methods in the library require that the size of the original file (uncompressed) can be determined and beat most 100MB, otherwise the library's methods throw an exception. The `decompress` method takes a `String` value as the path of a zip file, and a `String` value as the path of destination directory, and decompresses the zip file into the given directory. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute and there is no `IOException`.

```
01 // OMITTED: Import whatever is needed.
02 public final class ZipUtils {
03     private static final int BUFFER = 0x1000; // 4KB
04     private static final int MAX_FILE_SIZE = 0x6400000; // 100MB
05
06     public static void decompress (String path, String directory)
07         throws IOException {
08         FileInputStream fis = new FileInputStream(path);
09         ZipInputStream zis = new ZipInputStream(fis);
10         try {
11             ZipEntry entry;
12             while ((entry = zis.getNextEntry()) != null) {
13                 if (entry.getSize() < 0)
14                     throw new IllegalStateException("Size of file cannot be
15 determined") ;
16                 if (entry.getSize() > MAX_FILE_SIZE)
17                     throw new IllegalStateException("File is too large." ) ;
18
19                 // OMITTED: Store the "entry" in the "directory"
20             }
21         }
22         finally {
23             //OMITTED: close the streams
24         }
25     }
26 }
```

What will happen if the decompress method is called with a zip file containing an entry (named big.txt) larger than 100MB?

- A. big.txt won't be decompressed and the method will throw an exception.
- B. big.txt may or may not be decompressed.
- C. big.txt will be decompressed.
- D. The program will crash after the invocation of the decompress method.
- E. None of the above

ANSWER

A.

JDX02

SCENARIO

You are developing a library for file operations (e.g., copy, move). For the move operation, you write a static method that takes three arguments: `File source` (the path of an existing file), `File destination` (the path of destination file with an existing parent directory), `boolean overwrite` (whether the move method should overwrite the existing destination file), and returns a boolean: `true` if the operation succeeded, `false` otherwise. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed
02 public final class FileUtils {
03     public static boolean move (File source, File destination,
04         boolean overwrite) {
05         if (overwrite) {
06             if (destination.exists())
07                 destination.delete();
08             return source.renameTo(destination);
09         }
10         else if (!destination.exists()) {
11             return source.renameTo(destination);
12         }
13         else {
14             return false;
15         }
16     }
17 }
```

If a program calls the `move` method with arguments such that `source` exists, `destination` may or may not exist (but the `destination`'s parent directory exists), and `overwrite` is `true`, which one statement is correct?

- A. If the `move` method returns `true`, the source file is moved. Further, if the destination file existed, it has been overwritten.
- B. If the destination file existed, it has not been overwritten: the source file is not moved, even if the `move` method returns `true`.
- C. If the destination file exists, an exception is thrown and no data is overwritten.
- D. The `move` operation may fail, no matter what the `move` method returns.
- E. None of the above.

ANSWER

A.

JD96

SCENARIO

Many applications need to write data into temporary files. In some cases these files contain sensitive information and, therefore, must be deleted before the application terminates. Consider such an application that writes sensitive data into a temporary file and deletes this file when it finishes processing it. The snippet of code below shows the implementation of the processData method. This method receives data as an array of bytes and processes it. Since the data (in both original or processed form) is sensitive, after the application exits, the temporary files must be deleted. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public static class DataProcessingUtils {
03     public static byte[] processData (byte[] data)
04         throws IOException {
05     //OMITTED: prepare 'data' for processing
06
07     Path file = Files.createTempFile("file", ".tmp");
08     Files.write(file, data, StandardOpenOption.WRITE,
09                 StandardOpenOption.DELETE_ON_CLOSE);
10
11    //OMITTED: continue processing 'data'
12    //OMITTED: return the result of processing
13 }
14 }
```

If the JVM crashes after the execution of the processData method is completed, which one of the following is true?

- A. The temporary file will be deleted when the program crashes.

- B. An exception will be thrown and the program will print "Error in the processData method".
- C. The temporary file will not be deleted.
- D. The temporary file may or may not be deleted.
- E. The temporary file will be deleted only when the garbage collector runs.

ANSWER

D.

According to the API documentation when the `DELETE_ON_CLOSE` option is present then the implementation makes a best effort attempt to delete the file when closed by the appropriate `close` method. If the close method is not invoked then a best effort attempt is made to delete the file when the Java virtual machine terminates (either normally, as defined by the Java Language Specification, or where possible, abnormally). Thus it is not guaranteed that the temporary file will be deleted.

JD12

SCENARIO

You are developing a secure library for compression/decompression operations. All methods in the library require that the size of the original file (uncompressed) is at most 100MB, otherwise they throw an exception. The `decompress` method takes a `String` value as the path of a zip file, and a `String` value as the path of destination directory, and decompresses the zip file into the given directory. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute and there is no `IOException`.

```
01 // OMITTED: Import whatever is needed.
02 public final class ZipUtils {
03     private static final int BUFFER = 0x1000; // 4KB
04     private static final int MAX_FILE_SIZE = 0x6400000; // 100MB
05
06     public static void decompress (String path, String directory)
07         throws IOException {
08         FileInputStream fis = new FileInputStream(path);
09         ZipInputStream zis = new ZipInputStream(fis);
10         try {
11             ZipEntry entry;
12             while ((entry = zis.getNextEntry()) != null) {
13                 if (entry.getSize() > MAX_FILE_SIZE)
14                     throw new IllegalStateException("File is too large." );
15
16                 // OMITTED: Store the "entry" in the "directory"
17             }
18         } finally {
19             //OMITTED: close the streams
20         }
21     }
22 }
23 }
```

What will happen if the decompress method is called given a zip file containing an entry (named big.txt) larger than 100MB?

- A. big.txt won't be decompressed and the method will throw an exception.
- B. big.txt may or may not be decompressed.
- C. big.txt will definitely be decompressed.
- D. The program will crash after the invocation of the decompress method.
- E. None of the above

ANSWER

B.

The file (big.txt) still might be decompressed, since we are assigning the next file entry to zipEntry, we cannot rely on the getSize method. The getSize method may return -1 if the size of the entry (file) is unknown, so the above code is highly vulnerable as the attacker can modify the file size.

JDX24**SCENARIO**

You are developing a secure texting system. Text messages must be encrypted before being transferred over the network. The encrypt method takes two arguments: `text`, a String value to be encrypted, and `cipher`, a properly initialized Cipher object to process the encryption. The method returns a byte array representing the ciphertext of the original (plain) text. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class CryptoUtils {
03     public static byte[] encrypt (Cipher cipher, String text)
04         throws IOException {
05         ByteArrayOutputStream bytes = new ByteArrayOutputStream();
06         InputStream input = new ByteArrayInputStream(text.getBytes());
07         OutputStream processor = new CipherOutputStream(bytes, cipher);
08
09         // IOUtils.copy(input, processor): Reads all bytes from
10         // 'input' stream and writes them to 'processor' stream.
11         IOUtils.copy(input, processor);
12
13         processor.close();
14         return bytes.toByteArray();
15     }
16 }
```

Which one statement is correct if the `encrypt` method gets called to encrypt an arbitrary (non-null, non-empty) text with an arbitrary (properly initialized) Cipher object?

- A. The method always encrypts the text correctly.
- B. The method never encrypts the text correctly, and it throws an exception.
- C. The method never encrypts the text correctly, but it does not throw an exception.
- D. Depending on the cipher object, the method may encrypt the text correctly.
- E. None of the above.

ANSWER**A.****JD60****SCENARIO**

The Lightweight Directory Access Protocol (LDAP) is a protocol for accessing and maintaining distributed directory information services over an IP network. It allows an application to remotely perform operations, such as searching and modifying records in directories (directory servers). A common usage of LDAP is to provide single-sign-on (SSO) service where one user password is shared between many services.

You are developing an application that authenticates clients using the SSO service provided by the directory server of a company network. To perform the authentication, the authenticate method takes three String arguments: (1) base, the basename in the directory server, (2) user, the name of the account being authenticated, and (3) passwd, the password of the account. The method returns true if there is one, and only one, LDAP entry with the same credential information, and false otherwise. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```

01 // OMITTED: Import whatever is needed
02 public final class LdapAuthenticationProvider {
03     private static final Hashtable<String, Object> environment;
04
05     // OMITTED: Initialize the 'environment' field
06     // properly in the 'static' block of the class.
07
08     public static boolean authenticate (String base,
09             String user, String passwd) {
10         DirContext context;
11         try {
12             // A SearchControls object controls the search operation.
13             SearchControls sc = new SearchControls();
14             // OMITTED: Initialize 'sc' with the required parameters.
15
16             // The following query is used for authentication.
17             String qry = "(&(sn=" + user + ")(passwd=" + passwd + "))";
18
19             // This is the context in which you perform the query.
20             context = new InitialDirContext(environment);
21             NamingEnumeration<?> enmr = context.search(base, qry, sc);
22
23             // If there is more than one entry the authentication fails.
24             int count = 0;
25             while (enmr.hasMore() && enmr.next() != null)
26                 if (++count > 1) break;
27
28             return count == 1;
29         }
30         // OMITTED: Handle exceptions properly.
31         // OMITTED: In finally block, close the context.
32     }
33 }
```

Assuming that the environment field is properly initialized, and the directory server contains only two LDAP entries in the basename “dc=example,dc=com” with the following LDAP attributes (of type String): LDAP Entry #1: sn = “developer”, passwd = “12345678” LDAP Entry #2: sn = “administrator”, passwd = “Se34*a=d!”, which one statement is correct if the authenticate method gets called as: authenticate(“dc=example,dc=com”, “administrator”, “Se*”);

- A. The method returns false.

- B.** The method returns true.
- C.** The method throws a RuntimeException exception.
- D.** The method throws a NamingException exception.
- E.** None of the above.

ANSWER

B.

Using string concatenation to build an LDAP query makes it highly vulnerable to LDAP injection. In LDAP queries, the asterisk character is a wildcard (meaning it can be any sequence of characters). If the query (or some part of it) is coming from an untrusted source, the code must verify and sanitize it before sending it to the directory server. The above implementation builds the final query as “`(&(sn="administrator")(passwd="Se*"))`”, meaning search for entries with the specified sn and passwd starting with “Se”. This means anyone can get authenticated only by having the user account name, and without knowing the password (in fact, “Se*” can be simply replaced with “*” and the result is the same).

JD57

SCENARIO

You are developing a web application requiring authentication and authorization. The persistent store used for credential information (usernames and passwords) is a SQL database. The database has a table called “users” with three columns: “username” (the primary key), “password”, and “roles”. You are asked to write a helper method to get a username (a String value) and return its record containing roles information to the caller. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class DbUtils {
03     public static ResultSet getUser (String username)
04         throws SQLException {
05         String sql = "SELECT * FROM users WHERE username = ''"
06             + username.toLowerCase() + "'";
07
08         // Get a connection from the connection pool:
09         Connection conn = DbUtils.getConnectionPool().getConnection();
10         PreparedStatement stmt = conn.prepareStatement(sql);
11         return stmt.executeQuery();
12     }
13 }
```

If one calls the `getUser` method with an arbitrary `String` value given as `username`, which one statement is correct?

- A. The method reads and returns the `roles` field.
- B. The method may read and return the `username`, `roles`, and `password` fields.
- C. The method may read and return information from all users.
- D. The method may read and write information from all users.
- E. None of the above.

ANSWER

B.

Some programmers wrongly think that by using the `PreparedStatement` class, the SQL injection vulnerability can be resolved. The `PreparedStatement` class can resolve SQL injection vulnerability only if it is used correctly. Using string concatenation to build SQL query is highly vulnerable to SQL injection. In this implementation the query is still built by concatenation.

JD02

SCENARIO

You are developing a library for file operations (e.g., copy, move). For the move operation, you write a static method that takes three arguments: `File source` (the path of an existing file), `File destination` (the path of

destination file with an existing parent directory), boolean overwrite (whether the move method should overwrite the existing destination file), and returns a boolean: true if the operation succeeded, false otherwise. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed
02 public final class FileUtils {
03     public static boolean move (File source, File destination,
04         boolean overwrite) {
05         if (overwrite) {
06             if (destination.exists())
07                 destination.delete(); // You can assume the deletion
08             succeeds.
09             source.renameTo(destination);
10             return true;
11         }
12         else if (!destination.exists()) {
13             source.renameTo(destination);
14             return true;
15         }
16         else {
17             return false;
18         }
19     }
}
```

If a program calls the move method with arguments such that source exists, destination may or may not exist (but the destination's parent directory exists), and overwrite is true, which one statement is correct?

- A. If the move method returns true, the source file is moved. Further, if the destination file existed, it has been overwritten.
- B. If the destination file existed, it has not been overwritten: the source file is not moved, even if the move method returns true.
- C. If the destination file exists, an exception is thrown and no data is overwritten.
- D. The move operation may fail, no matter what the move method returns.
- E. None of the above.

ANSWER

D.

In the implementation above, checking if the destination file exists, deleting it, and moving the source file (lines 9, 10, and 11) are not atomic (likewise lines 14 and 15). Thus there is a possibility that right after checking for the file's existence (line 9 or 14), and deleting it if required (line 10), but before renaming the file (line 11 or 15), another process/thread creates a file with the same name (of the destination). This means that the rest of the code is about to write data on an existing file. Note that the behavior of the `renameTo` method when the destination file exists is platform-dependent. So that it may or may not succeed to overwrite the destination file. Since the code does not check the return value of the `renameTo` method after the call (line 11 or 15), it is not clear if the file is successfully moved/renamed to the destination or if it failed due to existence of the destination. After calling the `renameTo` method, the return value must be checked to see if the file is moved to the destination or not.

JD23**SCENARIO**

You are developing a secure texting system. The requirement asks to encrypt text messages before transferring them over network. The `encrypt` method takes three arguments: `String alg` (an encryption algorithm), `Key key` (a cryptographic key used for encryption), `String text` (a string value to be encrypted), and returns a byte array representing the ciphertext of the original (plain) text. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class CryptoUtils {
03     public static byte[] encrypt (String alg, Key key, String text)
04         throws GeneralSecurityException {
05     // Create a cipher
06     Cipher cipher = Cipher.getInstance(alg);
07     cipher.init(Cipher.ENCRYPT_MODE, key);
08
09     // Encrypt the data
10     byte[] input = text.getBytes();
11     byte[] output = new byte[input.length];
12
13     int length = cipher.update(input, 0, input.length, output, 0);
14     length += cipher.doFinal(output, length);
15     return output;
16 }
17 }
```

If the encrypt method gets called with a valid algorithm and valid key and a non empty string, which one statement is correct?

- A. Depending on the key, the encrypt method may encrypt the text correctly.
- B. Depending on the algorithm, the encrypt method may encrypt the text correctly.
- C. The encrypt method never encrypts the text correctly.
- D. The encrypt method always encrypts the text correctly.
- E. The encrypt method will lead to a crash in the program where it is invoked.

ANSWER

B.

The code snippet, as is, does not encrypt the data properly. Depending on the algorithm, the output of the encryption process (the output array) might be longer than the input of the encryption process (the input array). According to the API documentation the `getOutputSize` method of a `Cipher` object returns the length that an output buffer needs to have in order to hold the result of the next update or `doFinal` operation. Thus to make sure that the output array has enough space, it must be instantiated by the returned value of `cipher.getOutputSize(bytes.length)`

JDX15

SCENARIO

You are developing an application for managing files and directories. The application requires data on the average size of the files in each directory (excluding its subdirectories). The following code implements the `averageFileSize` method for this computation. The `averageFileSize` method takes one argument path (a `String` representing the path of a directory or file) and calculates and returns the average size of files in the given path if the given path is a directory, or returns the size of the file if the given path is a file. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class DirectoryUtils {
03     public static long averageFileSize (String path) {
04         // OMITTED: Acquire a FileLock object to prevent other
05         // processes from changing the path content while calculating
06         // the average file size. Assume nothing goes wrong here.
07
08         int count = 0;
09         long total = 0;
10         File file = new File(path);
11         if (file.isDirectory()) {
12             File[] files = file.listFiles();
13             if (files != null) {
14                 for (File child : files)
15                     if (child.isFile()) {
16                         count++;
17                         total += child.length();
18                     }
19             }
20         }
21         else if (file.isFile()) {
22             total = file.length();
23         }
24
25         // OMITTED: Release properly the FileLock object
26         // acquired at the beginning of the method.
27
28         if (count != 0)
29             return (total / count);
30         else
31             return total;
32     }
33 }
```

Which one statement is correct if the averageFileSize method gets called with a non-null, non-empty path as its argument?

- A. The method always returns an integer value (of type long).
- B. The method throws an exception on line 12, in case of any failure while getting the list of the directory content.
- C. The method throws an exception on lines 16 or 20, in case of any failure while reading the size of the file.

- D. The method throws an exception on a line other than 12, 16, or 20, in case of any failure while getting the list of the directory content.
- E. None of the above.

ANSWER

A.

According to the API documentation, none of the methods used in the code throw an exception.

JD11

SCENARIO

Consider an application that writes some information of its users to a file when users log in to the system. The application has one (and only one) “user information manager” (an object of type UserInfoFileManager) that handles creation and deletion of the file containing user information. As the file contains sensitive information, it must be deleted when the application terminates. In the following implementation of the class, the file is created when an instance of the class is created (in the constructor) and is deleted in the `finalize` method (which is to be called by the garbage collector on the “user information manager” when garbage collection determines that there are no more references to it.). Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class UserInfoFileManager {
03     private final File file;
04
05     /**
06      * Default constructor, initialize the "file" member
07      */
08     public UserInfoFileManager () {
09         file = new File("users.info");
10     }
11
12     /**
13      * This method writes the given information into the file.
14      * @param information the information to be written
15      * @throws IOException IOException thrown during writing
16      */
17     public final void write (String information)
18         throws IOException {
19         try (FileOutputStream output = new FileOutputStream(file)) {
20             output.write(information.getBytes());
21         }
22     }
23
24     // Delete the file during the object finalization
25     public void finalize () throws Throwable {
26         file.delete();
27         super.finalize();
28     }
29 }
```

Considering the file pointed by the `file` member, and assuming that the application is the only process having access to the file, which one statement is correct?

- A. The file might be deleted (via the `finalize` method call) while the application is writing to it (via the `write` method call).
- B. The file is always deleted when the application terminates.
- C. The file is never deleted.
- D. It is not possible to do I/O operations in the `finalize` method.
- E. None of the above

ANSWER

E.

The file may or may not be deleted. The `finalize` method is called when an object is about to get garbage collected. That can be at any time after the object (“user information manager” in this case) has become eligible for garbage collection. Note that it is entirely possible that an object never gets garbage collected. This can happen when the object never becomes eligible for garbage collection or when no garbage collection actually runs between the time the object became eligible and the time the JVM stops running.

JDX10

SCENARIO

You are developing a library for common I/O operations. One of the methods of this library, `readAllBytes`, takes one argument: `InputStream input` (the stream to be read), reads the stream content, and returns the result as a byte array. The snippet of code below is an implementation of the `readAllBytes` method and its test case. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class IOUtils {
03     private static final int BUFFER_SIZE = 1024;
04
05     public static byte[] readAllBytes (InputStream input)
06         throws IOException {
07         ByteArrayOutputStream bytes;
08         bytes = new ByteArrayOutputStream(BUFFER_SIZE);
09
10         byte[] buffer = new byte[BUFFER_SIZE];
11         int length = 0;
12         while ((length = input.read(buffer)) != -1)
13             bytes.write(buffer, 0, length);
14
15         return bytes.toByteArray();
16     }
17
18     @Test
19     public static void testReadAllBytes () throws IOException {
20         byte[] sample = ...; // A byte array, not null, not empty;
21         InputStream stream = new ByteArrayInputStream(sample);
22         byte[] result = readAllBytes(stream);
23         assert Arrays.equals(sample, result);
24     }
25 }
```

Suppose that `testReadAllBytes` is executed with a non-null, non-empty array as the `sample` variable? (Assume there are no IO exceptions while the code is executed.) Which one statement is correct?

- A. The `readAllBytes` method always passes the test.
- B. The `readAllBytes` method never passes the test.
- C. The `readAllBytes` method is implemented correctly, but it may not pass the test.
- D. The `readAllBytes` method is implemented incorrectly, but it may pass the test.
- E. None of the above.

ANSWER

- A.

If the integer value returned by the read method is ignored, there is no way to get the number of the actual bytes read by the method and stored in the buffer.

JD51

SCENARIO

You are developing a web application that runs on the Linux OS and that provides server administration functionalities (e.g. changing the hostname of server). Since there's no built-in feature in Java to change the hostname of machine, you have to use a Linux command to do so. The setHostname method takes a String as the new hostname, attempts to change the hostname of the server, and returns true if it succeeded, and false otherwise.. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed
02 public final class SystemUtils {
03     public static boolean setHostname (String hostname)
04         throws Exception {
05         String cmd = "hostname '" + hostname + "'";
06         ProcessBuilder builder = new ProcessBuilder("sh", "-c", cmd);
07         Process process = builder.start();
08         int exit = process.waitFor();
09
10         if (exit == 0)
11             return true;
12         else
13             return false;
14     }
15 }
```

If a program calls the setHostname method as `setHostname("'$shutdown'")`, which one statement is correct?

- A. setHostname throws an exception due to invalid character in the argument.
- B. setHostname fails and returns false because of the invalid character in the argument.
- C. setHostname sets the hostname of the server to “shutdown”.
- D. setHostname sets the hostname of the server to “0”.
- E. None of the above.

ANSWER

E.

The code is trying to enclose the argument in single quotes to prevent inline-command evaluation (line #5). However, since the single quote (if there is any in the argument) is not escaped, the inline-command injection is still possible. For the given string in the question, the “shutdown” command (as inline-command) in the argument will be executed before executing the “hostname” command.

JD86

SCENARIO

You are developing a system which deals with lots of numbers. You have a utility class which helps with formatting of numbers. The `format` method takes a `String input`, and inserts a record into the log file, if the `input` is not a number. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class NumberUtils {
03     public static void format (String input)
04         throws Exception {
05     try{
06         int value = Integer.parseInt(input);
07     }
08     catch(NumberFormatException e){
09         log.info("Failed to parse input: " + input);
10     }
11
12     // OMITTED: Further processing.
13     // OMITTED: Close all resources properly.
14 }
15
16
17
```

If the `format` method gets called, which one statement is correct?

- A. It parses all the inputs successfully to an integer value and does not log anything.
- B. It only logs the inputs for which the `parseInt` method throws `NumberFormatException`.
- C. Depending on the value of the input, the method may log some other messages as well.
- D. It logs at least one message for every execution.
- E. None of the above.

ANSWER

C.

If the input is passed as `twenty-one%0a%0aINFO:+User+logged+out%3dadmin`, then the method logs the following:

`INFO: Failed to parse val=twenty-one`

`INFO: User logged out=admin`

JD93

SCENARIO

Many applications need to write data into temporary files. In some cases these files contain sensitive information and, therefore, must be deleted before the application terminates. Consider such an application that writes sensitive data into a temporary file and deletes this file when it finishes processing it. The snippet of code below represents part of a simplified version of this application. The `processFile` method is called to create the temporary file, and the `sysSafeExit` method when the program ends normally. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public static class ProcessTempFile {
03     /**
04      * This method creates a temporary file and calls deleteOnExit
05      * to delete the file on Java JVM exit. The data that has to be
06      * written into the temporary file is passed as a String to the
07      * processFile method.
08     */
09     public static void processFile (String data)
10         throws IOException {
11         File file = new File("temp.tmp");
12         file.deleteOnExit();
13         try (FileOutputStream output = new FileOutputStream(file)) {
14             output.write(data.getBytes());
15             //OMITTED: Other file processing
16         }
17         Catch (Exception e) {
18             System.out.println("Error in the processFile method");
19         }
20     }
21
22     public void sysSafeExit() {
23         //OMITTED: Program safely terminates;
24     }
25 }
```

Suppose the JVM crashes after the method `processFile` is executed, but before method the `sysSafeExit` is called. Which one of the following is true?

- A. The temporary file will be deleted when the program crashes, because the `deleteOnExit` method is called.
- B. An exception will be thrown and the program will print “Error in the `processFile` method” before crashing.
- C. The temporary file will not be deleted.
- D. The temporary file may or may not be deleted.
- E. The temporary file will only be deleted when the garbage collector runs.

ANSWER

C.

It is not guaranteed that the temporary file will be deleted. Even though the `deleteOnExit` method is called, as defined by the Java Language Specification, deletion will be attempted only for normal termination of the virtual machine.

JDX23

SCENARIO

You are developing a secure texting system. The requirement asks to encrypt text messages before transferring them over network. The encrypt method takes three arguments: `String alg` (an encryption algorithm), `Key key` (a cryptographic key used for encryption), `String text` (a string value to be encrypted), and returns a byte array representing the ciphertext of the original (plain) text. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class CryptoUtils {
03     public static byte[] encrypt (String alg, Key key, String text)
04         throws GeneralSecurityException {
05     // Create a cipher
06     Cipher cipher = Cipher.getInstance(alg);
07     cipher.init(Cipher.ENCRYPT_MODE, key);
08
09     // Encrypt the data
10     byte[] input = text.getBytes();
11     byte[] output = new byte[cipher.getOutputSize(input.length)];
12
13     int length = cipher.update(input, 0, input.length, output, 0);
14     length += cipher.doFinal(output, length);
15     return output;
16 }
17 }
```

If the encrypt method gets called with a valid algorithm and valid key and a non empty string, which one statement is correct?

- A. Depending on the key, the encrypt method may encrypt the text correctly.
- B. Depending on the algorithm, the encrypt method may encrypt the text correctly.
- C. The encrypt method never encrypts the text correctly.
- D. The encrypt method always encrypts the text correctly.
- E. The encrypt method will lead to a crash in the program where it is invoked.

ANSWER

D.**JDX01****SCENARIO**

You are developing a library for file operations (e.g., copy, move). For the copy operation, you write a method that takes three arguments: a source file's path, a destination file's path, and a boolean flag indicating if the destination file should be overwritten. The following is an implementation of the copy method. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class FileUtils {
03     /**
04      * This method copies the contents of the specified source file
05      * to the specified destination file. The source file and the
06      * directory holding the destination file have to exist.
07      * If 'overwrite' argument is true, then the method will
08      * overwrite the destination file if it exists.
09      *
10     * @param source
11     *         the path to an existing file
12     * @param destination
13     *         the path of a destination file
14     * @param overwrite
15     *         whether the copy method should overwrite existing
16     *         destination file
17     * @return true, if the operation succeeded, otherwise false
18     * @throws NullPointerException if source or destination is null
19     *         IOException if an I/O error occurs
20     */
21     public static boolean copy (File source, File destination,
22         boolean overwrite) throws IOException {
23         InputStream input = null;
24         OutputStream output = null;
25         try {
26             if (!overwrite && destination.exists())
27                 return false;
28
29             if (destination.createNewFile() || overwrite) {
30                 input = new FileInputStream(source);
31                 output = new FileOutputStream(destination);
32
33                 // OMITTED: By using 'input' and 'output', read all bytes
34                 // from 'source' and write them into 'destination'. At the
35                 // end, 'source' and 'destination' contain the same data.
36
37                 return true;
38             }
39             return false;
40         }
41         // OMITTED: In finally block, close all open streams;
42     }
43 }
```

What will the copy method do when executed?

If a program calls the copy method with arguments such that source exists, destination may or may not exist (but destination's parent directory exists), and overwrite = false, which one statement is correct?

- A.** No existing file is overwritten.
- B.** If the destination file exists, an exception is thrown and no data is overwritten.
- C.** If the destination file exists, the method fails to prevent overwriting the existing destination file. However, it is possible to implement a method such that the file is not overwritten.
- D.** An implementation that guarantees existing files will not be overwritten is impossible in Java.
- E.** None of the above.

ANSWERS

1.) The method makes a copy of a file by copying its content to a new file, or by overwriting its content to an existing file, if overwrite = true.

2.) **A.**

JD24

SCENARIO

You are developing a secure texting system. Text messages must be encrypted before being transferred over the network. The encrypt method takes two arguments: `text`, a String value to be encrypted, and `cipher`, a properly initialized Cipher object to process the encryption. The method returns a byte array representing the ciphertext of the original (plain) text. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```
01 // OMITTED: Import whatever is needed.
02 public final class CryptoUtils {
03     public static byte[] encrypt (String text, Cipher cipher)
04         throws IOException {
05         byte[] bytes = text.getBytes();
06         try (
07             InputStream input = new ByteArrayInputStream(bytes);
08             ByteArrayOutputStream output = new ByteArrayOutputStream();
09             OutputStream proc = new CipherOutputStream(output, cipher)
10         ) {
11             // The following statement reads all bytes from
12             // 'input' stream and writes them to 'proc' stream.
13             IOUtils.copy(input, proc);
14
15             // Return the ciphertext (as a byte array).
16             return output.toByteArray();
17         }
18     }
19 }
```

Which one statement is correct if the encrypt method gets called to encrypt an arbitrary (non-null, non-empty) text with an arbitrary (properly initialized) Cipher object?

- A. The method always encrypts the text correctly.
- B. The method never encrypts the text correctly, and it throws an exception.
- C. The method never encrypts the text correctly, but it does not throw an exception.
- D. Depending on the cipher object, the method may encrypt the text correctly.
- E. None of the above.

ANSWER

D.

According to the API documentation, while using CipherOutputStream or CipherInputStream object, to finalize the (encryption or decryption) process, the close method should be called on the stream object. If not, the produced data (plaintext or ciphertext) is invalid. This implementation is using try-with-resource feature of Java (lines 6~9). So that all resources (in this case streams) defined in the initialization statement (lines 6~9) are going to be closed right after the execution of the last statement of the try block (line

16). That means the `CipherOutputStream` object is going to be closed after collecting the produced data (line 16 by calling the `toByteArray` method). Thus, even though the method does not throw any exception, the produced data (in this case ciphertext) is invalid and cannot be decrypted to the original text. Depending on how the `cipher` object is initialized, in some cases this code might work. Generally it is not the correct way of using cipher streams. To fix the code the output variable should be taken out of the try block, and the `toByteArray` method should be called right after the try block ends.

JD65

SCENARIO

You are developing an account-management service to be used for account registration and authentication. To register an account, a client has to provide a username and a password. According to the registration guidelines, a username can be any non-empty string. Note that a null string is considered an empty string. The username cannot appear in the password. The register method takes two arguments: `String user` (the username of the account), and `String pass` (the password of the account). After checking the validity of the username and password, if both are valid, the account is registered in the database. Otherwise, the method throws an `IllegalArgumentException`. Consider the snippet of code below and answer the following questions, assuming that the code has all required permissions to execute.

```

01 // OMITTED: Import whatever is needed.
02 public final class AccountManager {
03     public static void register (String user, String pass) {
04         if (user == null || user.isEmpty())
05             throw new IllegalArgumentException("Bad Username!");
06         if (pass == null || pass.isEmpty())
07             throw new IllegalArgumentException("Bad Password!");
08
09         // Use regex to check the similarity.
10         Pattern pattern = Pattern.compile("(.*?)" + user);
11         boolean similar = pattern.matcher(pass).matches();
12
13         if (similar)
14             throw new IllegalArgumentException("Weak Password!");
15
16         // OMITTED: Continue to create the account in the database.
17     }
18 }
```

Which one statement is correct if the register method gets called as:

`register("(a+)+", "aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa!");`

- A. The password is checked and the account is created.
- B. The method throws an `IllegalArgumentException` with “Bad Password!”
- C. The method throws an `IllegalArgumentException` with “Weak Password!”
- D. The method throws a `PatternSyntaxException`.
- E. None of the above.

ANSWER

E.

The given username (being used as the regex pattern) is a potential evil regex. Having the username, the process of matching (line 11) takes too long to finish and keeps the current thread busy, meaning the call given in the question keeps running (almost) forever. After multiple attempts to call the register method with the same arguments, the application might reach the maximum number of running threads and become unresponsive.

22-Quality Check Qs

How clear and functional were the written instructions during the survey? (1=Not clear at all, 5=Very Clear)



How was the audio quality of the narrated portions of the survey (was it clear, precise and intelligible)? (1=Not clear at all, 5=Very Clear)



Did you face any bugs/errors when completing the survey?

- Yes
- No

Please describe the issue(s):

What browser are you using?

Do you have any feedback or suggestions for the study survey in general?

Would you like to recommend this study to a friend or colleague?

- Yes
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Please enter the appropriate information into the **fields below**. Your friend/colleague will then be promptly notified of this research opportunity.

Your First name

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The First name of your friend/colleague

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Is your friend/colleague a student or a professional? Retired professionals are eligible as well.

- Student
- Professional

23-Compensation

Thank you very much for your participation! This ends the **Developer Code Perception study**. You are now entitled to the full study compensation in the form of a **\$20** Amazon gift card. This will be sent to the email that you provided in the survey within the next 2-3 business days.

If you have any further questions or concerns, you may contact us at our primary lab number

(352) 273-2134 or you may email us at **psy-ebnerlab@psych.ufl.edu**.

Please click the "**Next**" button to fully submit your survey responses.

When done, please feel free to toggle your browser Flash settings back to their recommended levels.

Once again, thank you for your contribution to our research!

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