

Teaching Unit 2: Boolean Logic and Conditionals

2.1 Boolean Operators

Solutions

2.1.1 - Trace

Determine the exact output. Explain the Java rule or state changes that produce it.

```
boolean a = true;  
boolean b = false;  
System.out.println(!a || b && a);
```

Output

false

Evaluate `!`, then `&&`, then `||`. Each side of the final disjunction is false.

2.1.2 - Write code

For `int x = 10`, print whether `x` lies outside the inclusive interval 3 through 8. Use De Morgan's law to write the condition without `!`.

One valid solution is shown below. Other implementations satisfying the contract are also valid.

```
int x = 10;  
boolean outside = x < 3 || x > 8;  
System.out.println(outside);
```

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2.2 If/Else Tracing

Solutions

2.2.1 - Trace

Determine the exact output. Explain the Java rule or state changes that produce it.

```
int n = 6;  
if (n > 3) n -= 2;  
if (n > 3) n *= 2;  
System.out.println(n);
```

Output

8

The first independent if changes n to 4; the second sees that updated value.

2.2.2 - Write code

Given `int temperature = 0`, print freezing for values at most 0, cool for values from 1 through 15, and warm otherwise.

One valid solution is shown below. Other implementations satisfying the contract are also valid.

```
int temperature = 0;  
if (temperature <= 0) {  
    System.out.println("freezing");  
} else if (temperature <= 15) {  
    System.out.println("cool");  
} else {  
    System.out.println("warm");  
}
```

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2.3 Compound Conditions

Solutions

2.3.1 - Trace

Determine the exact output. Explain the Java rule or state changes that produce it.

```
int n = 5;  
System.out.println(n < 2 || n >= 5 && n < 8);
```

Output

true

The && group is true, making the full disjunction true.

2.3.2 - Write code

Write public static boolean eligible(int age, boolean permission). Return true for adults age 18 or older, or for ages 14 through 17 with permission. Younger applicants are ineligible.

One valid solution is shown below. Other implementations satisfying the contract are also valid.

```
public static boolean eligible(int age, boolean permission) {  
    return age >= 18 || (age >= 14 && permission);  
}
```

Check your code

```
System.out.println(eligible(13, true));  
System.out.println(eligible(14, true));  
System.out.println(eligible(17, false));  
System.out.println(eligible(18, false));
```

Expected output

false
true
false
true

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2.4 Short-Circuit Logic

Solutions

2.4.1 - Trace

Determine the exact output. Explain the Java rule or state changes that produce it.

```
int n = 0;  
System.out.println(n == 0 || 12 / n > 2);
```

Output

true

The first operand is true, so the division by zero is skipped.

2.4.2 - Write code

Write public static boolean startsWithA(String text), allowing null or empty input. Return true only if its first character, represented as a one-character substring, is "A".

One valid solution is shown below. Other implementations satisfying the contract are also valid.

```
public static boolean startsWithA(String text) {  
    return text != null && text.length() > 0  
        && text.substring(0, 1).equals("A");  
}
```

Check your code

```
System.out.println(startsWithA(null));  
System.out.println(startsWithA(""));  
System.out.println(startsWithA("Apple"));  
System.out.println(startsWithA("apple"));
```

Expected output

```
false  
false  
true  
false
```