1806ICT
Programming Fundamentals

Boolean Expressions: Examples and Problems

Example 1

Given two integers a and b and two inclusive ranges -8..-4 and 10..16 write a boolean expression which is true if both integers are in one of these ranges or both integers are not in these ranges.

	Condition	C Boolean Expression
1	a is in the range -8 .. -4	a >= -8 && a <= -4
2	a is in the range 10 .. 16	a >= 10 && a <= 16
3	b is in the range -8 .. -4	b >= -8 && b <= -4
4	b is in the range 10 .. 16	b >= 10 && b <= 16
1 or 2	bool aInRange =	(a >= -8 && a <= -4) || (a >= 10 && a <= 16)
3 or 4	bool bInRange =	(b >= -8 && b <= -4) || (b >= 10 && b <= 16)
((1 or 2) and (3 or 4)) or (not (1 or 2) and not (3 or 4))		(aInRange && bInRange) || (!aInRange && !bInRange)

Example 2

Given two integers a and b determine if a is in the inclusive range 1 .. 100 and a is less than the b OR if a is at least twice b and b is not in the inclusive range -8..16.

	Condition	C Boolean Expression
1	a is in the range 1 .. 100	a >= 1 && a <= 100
2	a is less than b	a < b
3	a is at least twice b	a >= 2 * b
4	b is not in the range -8..16	!(b >= -8 && b <= 16) which is equivalent to !(b >= -8) || !(b <= 16) which is equivalent to (b < -8 || b > 16)
	1 and 2	(a >= 1 && a <= 100) && a < b
	3 and 4	a >= 2 * b && (b < -8 || b > 16)
	(1 and 2) or (3 and 4)	((a >= 1 && a <= 100) && a < b) || (a >= 2 * b && (b < -8 || b > 16))

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PROBLEM 1

Answer: A

The Boolean expression

(A **&&** B) **||** (A **&&** C)

is equivalent to which of the following expressions?

(A) A **&&** (B **||** C)
(B) A **||** (B **&&** C)
(C) (A **||** B) **&&** (A **||** C)
(D) A **&&** B **&&** C
(E) A **||** B **||** C

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PROBLEM 2

Answer: B

The Boolean expression

(A || B) **&&** B

is **true**

(A) only when A is true.
(B) only when B is true.
(C) whenever either A is true or B is true.
(D) only whenever both A is true and B is true.
(E) for all values of A and B.

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PROBLEM 3

Answer: D

The Boolean expression

(A **&&** B) **&&** A

is true

(A) only when A is true.
(B) only when B is true.
(C) whenever either A is true or B is true.
(D) only whenever both A is true and B is true.
(E) for all values of A and B.

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PROBLEM 4

Answer: C

The Boolean expression

(A || B) **&&** (A || B)

is true

(A) only when A is true.
(B) only when B is true.
(C) whenever either A is true or B is true.
(D) only whenever both A is true and B is true.
(E) for all values of A and B.

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PROBLEM 5

Answer: D

The Boolean expression

!(A **&&** B)

is equivalent to which of the following expressions?

(A) A != B
(B) **!**A **&&** B
(C) A || B
(D) **!**A || **!**B
(E) **!**A **&&** **!**B

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PROBLEM 6

Answer: A

The Boolean expression

(A **&&** B) **&& !**(A **&&** B)

evaluates to

(A) false in all cases.
(B) true in all cases.
(C) true whenever only A is true or only B is true.
(D) true whenever both A is true and B is true.
(E) false only when both A is false and B is false.

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PROBLEM 7

Answer: A

The Boolean expression

(A **||** B) **&& !**(A **||** B)

evaluates to

(A) false in all cases.
(B) true in all cases.
(C) true whenever only A is true or only B is true.
(D) true whenever both A is true and B is true.
(E) false only when both A is false and B is false.

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PROBLEM 8

Answer: A

Given integers x and y, the Boolean expression

(x > y) **&&** (x <= y)

can be simplified to which of the following expressions?

(A) **false**
(B) **true**

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PROBLEM 9

Answer: A

The Boolean expression

(A **&&** B) **||** (**!**A **||** **!**B)

evaluates to

(A) true in all cases.
(B) false in all cases.
(C) true only whenever both A is true and B is true.
(D) false only whenever both A is false and B is false.
(E) true only whenever A is true or B is true.

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PROBLEM 10

Answer: D

Consider the following program segment.
Assume that **X** is a Boolean variable.

```
X = !(X == true);
```

(A) X will always be true.
(B) X will always be false.
(C) The value of X does not change.
(D) The value of X always changes.
(E) The result cannot be determined with the given information

X	X == true	!(X == true)
T	T	F
F	F	T

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