Boolean expressions
Conditionals

Learning to test functions

Relational operators

- Remember: = is the Python assignment operator
  - It is a command to evaluate the right-hand side and make the variable on the left refer to that result
  - In math (not Python!), = is a claim that two expressions are equal
- == is the Python operator that tests for equality
  - Other relational operators: > >= < <= != (the last one means "not equal")
  - They return $\boxed{\text{bool (Boolean)}}$ values

$\rightarrow$ True or False

Concept Test

What is the output of the following code?

```
a = 3
b = (a != 3)
print(b)
```

$\xrightarrow{}$ Boolean expression

b = (3 != 3)

b = False

- A. True
- [✓ B.] False
- C. 3
- D. Syntax error

Functions returning Boolean values

Write a function that returns True if x is an integer otherwise returns False

Refer to code written in lecture

Logical operators

- The logical operators take one (`not`) or two (`and`, `or`) bools and return a bool
- An expression involving `not` produces `True` if the original value is `False`, and `False` if the original value is `True`
- `And` produces `True` exactly when both of its operands are `True`
- `or` produces `True` exactly when at least one of its operands is `True`

not , and , or

not $\underline{\text{True}}$ → False

not False → True

In Python

0 → False, every other number is True

"" → Empty String is False
every other string True

[ ] → Empty List is False

( ) → Empty Tuple false

$\underline{\text{True}}$ and $\underline{\text{True}}$ → True

True and False → False

False and True → False

False and False → False

$x = 5$

$$\underbrace{(x < 10)}_{\text{Boolean expr.}} \text{ and } \underbrace{(x == 5)}_{\text{Boolean exp}}$$

True or True → True

False or True → True

True or False → True

False or False → False

Python Operators

Precedence

( )	Highest
**	
Unary negation, e.g. -x: -	
* / %	
+ -	
> < ==	
not	
and	
or	
=	Lowest

Caution Level

set equal to	=
divide	/
remainder	%
power	**
is equal to	==
as usual	*
	+
	>
	<
	-
	( )

(not a) and c

It's not worth remembering all these %+/* things!

I'd go with parentheses over precedence

Concept Test

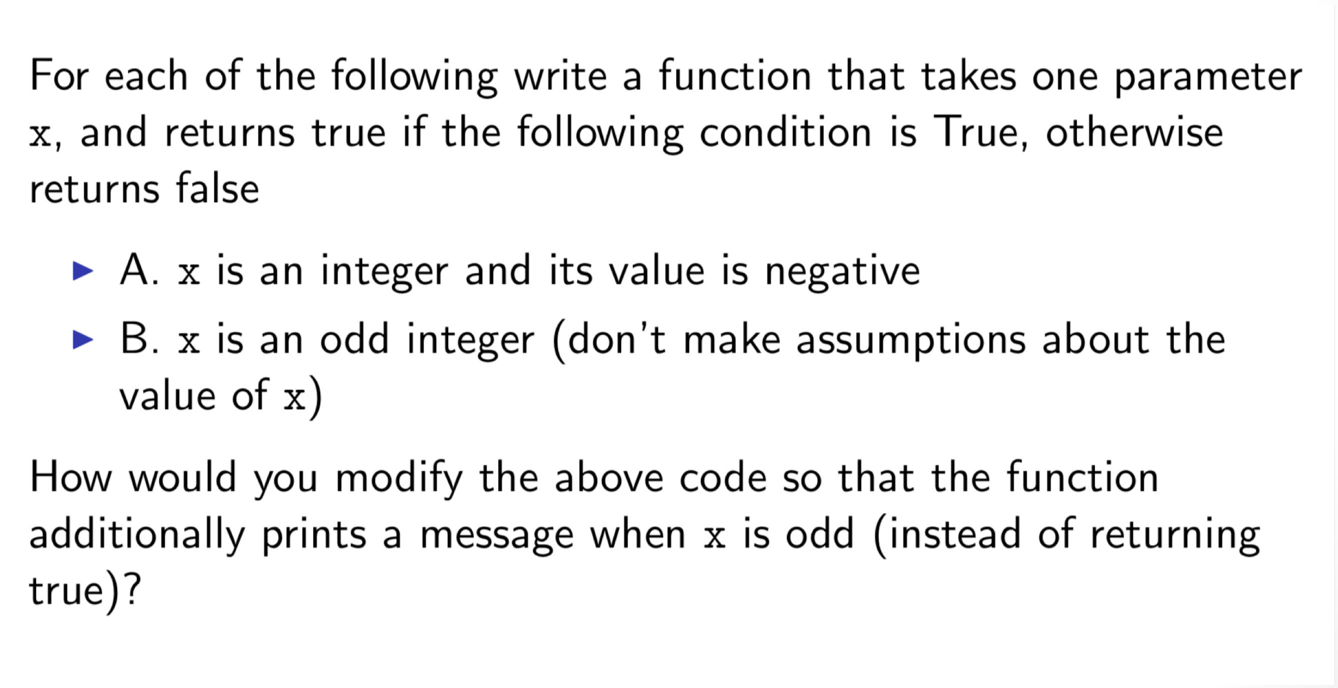
What is the value of the expression at the bottom of the code? (Remember that `not` has the highest precedence, then `and`, then `or`.)

```
a = True
b = False
c = True
((not a) and b) or c
```

False and False

- [✓ A.] `True`
- B. `False`

More functions returning Boolean



For each of the following write a function that takes one parameter `x`, and returns true if the following condition is True, otherwise returns false

- A. `x` is an integer and its value is negative
- B. `x` is an odd integer (don't make assumptions about the value of `x`)

How would you modify the above code so that the function additionally prints a message when `x` is odd (instead of returning true)?

If and If Else

```
if <condition>:
  <sequence of statements>
```

If the condition evaluates to True, execute sequence of statements, otherwise jump to end of if block

```
if <condition>:
  <sequence of statements-1>
else:
  <sequence-of-statements2>
```

If the condition evaluates to True, execute code inside if block, otherwise execute code in the else block

Concept Test

What is the value of x after this code executes?

```
x = 5
if x > 2:
   x = -3
   x = 1
else:
   x = 3
   x = 2
```

- A. -3
- [✓ B. 1]
- C. 2
- D. 3
- E. 5

Fizzbuzz

- Write a program for the game fizzbuzz
- Your program should take an input n
- If n is a multiple of 3, print Fizz
- If n is a multiple of 5, print Buzz
- If n is a multiple of both 3 and 5, print FizzBuzz
- If n if not a multiple of 3 or 5, print n

Please refer to code written in lecture