BRANCHING, ITERATION

Follow along on the Repl.it!

COMP100 LECTURE 2

LAST TIME

- syntax and semantics
- scalar objects
- simple operations
- expressions, variables and values

TODAY

- string object type
- branching and conditionals
- indentation
- iteration and loops

STRINGS

- letters, special characters, spaces, digits
- enclose in quotation marks or single quotes

```
hi = "hello there"
```

- concatenate strings

```
name = "ana"

greet = hi + name

greeting = hi + " " + name
```

- do some operations on a string as defined in Python docs

```
silly = hi + " " + name * 3
```

INPUT/OUTPUT: `print`

- used to **output** stuff to console
- keyword is print

```
x = 1
print(x)
x_str = str(x)
print("my fav num is", x, ".", "x =", x)
print("my fav num is " + x_str + ". " + "x = " + x_str)
```

INPUT/OUTPUT: `input("")`

- prints whatever is in the quotes
- user types in something and hits enter
- binds that value to a variable

```
text = input("Type anything... ")
print(5*text)
```

- `input` gives you a string so must cast if working with numbers

```
num = int(input("Type a number... "))
print(5*num)
```

COMPARISON OPERATORS ON `int, float,string`

- `i` and `j` are variable names
- comparisons below evaluate to a Boolean

```
i > j
i >= j
i < j
i <= j
```

COMPARISON OPERATORS ON `int, float,string`

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`i > j`

`i >= j`

`i < j`

`i <= j`

`i == j` → equality test, `True` if `i` is the same as `j`

`i != j` → inequality test, `True` if `i` not the same as `j`

LOGIC OPERATORS ON `bool`

- a and b are variable names (with Boolean values)

`not a` → `True` if a is `False`
`False` if a is `True`

`a and b` → `True` if both are `True`

`a or b` → `True` if either or both are `True`

LOGIC OPERATORS ON `bool`

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`False` if a is `True`

`a and b` → `True` if both are `True`

`a or b` → `True` if either or both are `True`

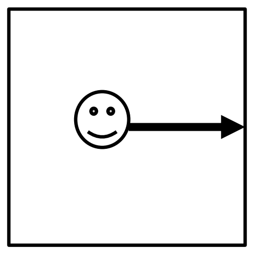
A	B	A and B	A or B
True	True	True	True
True	False	False	True
False	True	False	True
False	False	False	False

COMPARISON EXAMPLE

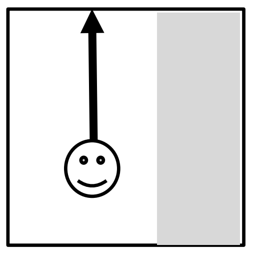
```
lab_time = 8
alarm_time = 8
print(lab_time < alarm_time)
```

COMPARISON EXAMPLE

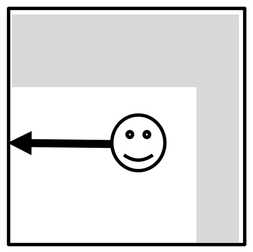
```
drive = True
drink = False
drunk_driving = drink and drive
print(drunk_driving)
```



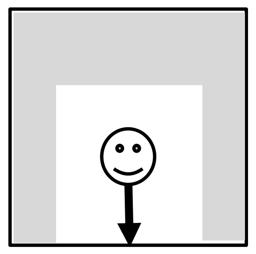
If right clear, go right



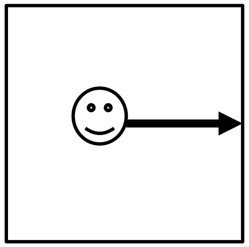
If right blocked, go forward



If right and front blocked, go left



If right , front, left blocked, go back



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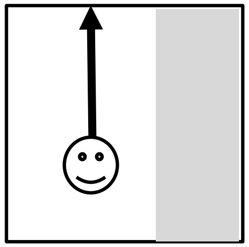

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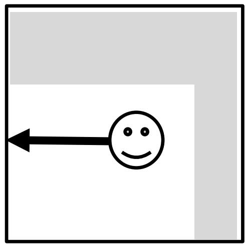

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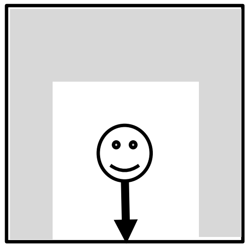

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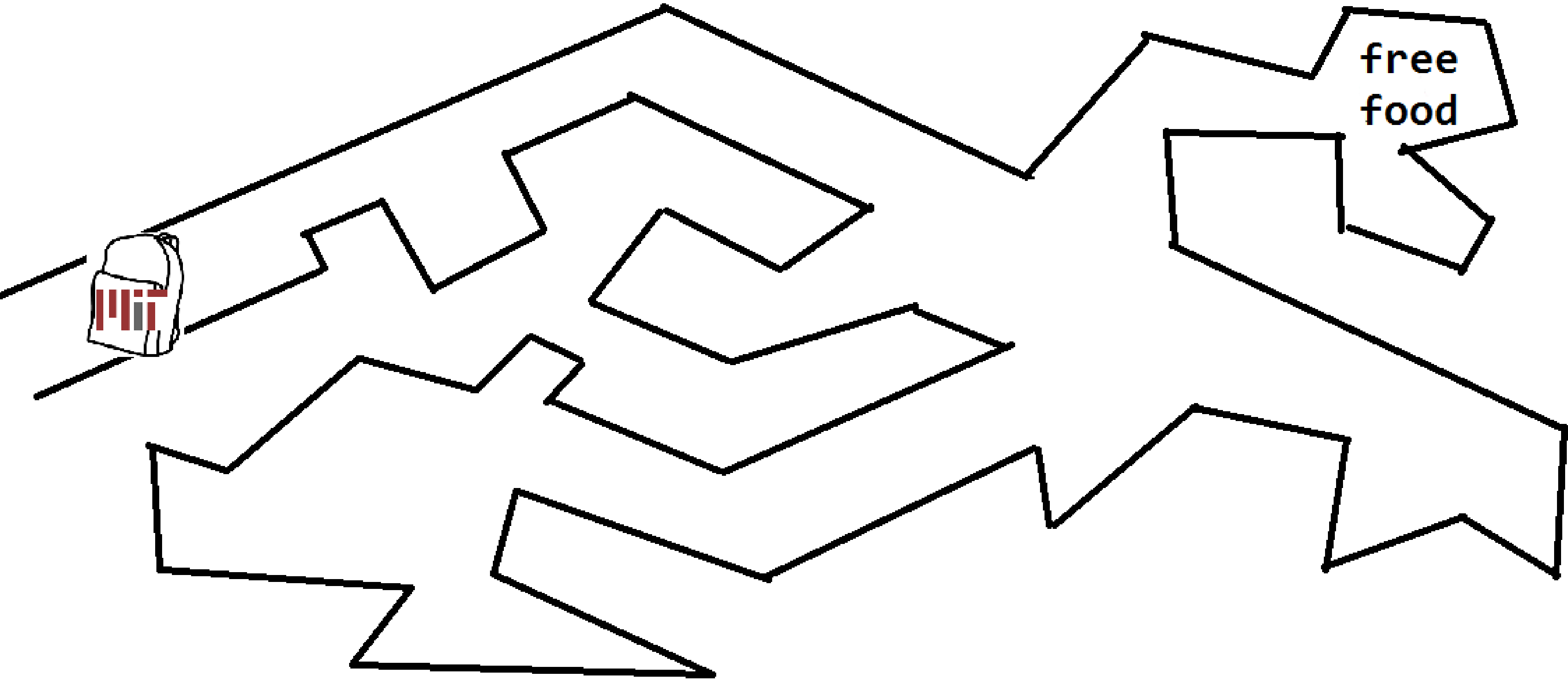


CONTROL FLOW - BRANCHING

```
if <condition>:
    <expression>
    <expression>
    ...
```

- `<condition>` has a value `True` or `False`
- evaluate expressions in that block if `<condition>` is `True`

CONTROL FLOW - BRANCHING

```
if <condition>:
    <expression>
    <expression>
    ...
```

```
if <condition>:
    <expression>
    <expression>
    ...
else:
    <expression>
    <expression>
    ...
```

- `<condition>` has a value `True` or `False`
- evaluate expressions in that block if `<condition>` is `True`

CONTROL FLOW - BRANCHING

```
if <condition>:
    <expression>
    <expression>
    ...
```

```
if <condition>:
    <expression>
    <expression>
    ...
else:
    <expression>
    <expression>
    ...
```

```
if <condition>:
    <expression>
    <expression>
    ...
elif <condition>:
    <expression>
    <expression>
    ...
else:
    <expression>
    <expression>
    ...
```

- `<condition>` has a value `True` or `False`
- evaluate expressions in that block if `<condition>` is `True`

INDENTATION

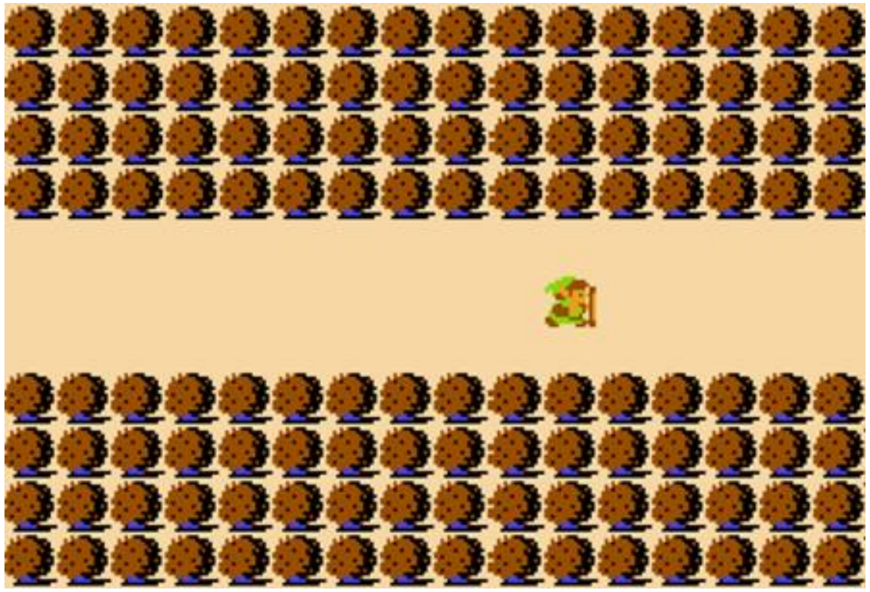
- matters in Python
- how you denote blocks of code

```
x = float(input("Enter a number for x: "))
y = float(input("Enter a number for y: "))
if x == y:
    print("x and y are equal")
    if y != 0:
        print("therefore, x / y is", x/y)
elif x < y:
    print("x is smaller")
else:
    print("y is smaller")
print("thanks!")
```

= VS ==

```
x = float(input("Enter a number for x: "))
y = float(input("Enter a number for y: "))
if x == y:
    print("x and y are equal")
    if y != 0:
        print("therefore, x / y is", x/y)
elif x < y:
    print("x is smaller")
else:
    print("y is smaller")
print("thanks!")
```

What if x = y here?
get a SyntaxError



- Legend of Zelda –Lost Woods
- keep going right, takes you back to this same screen, stuck in a loop

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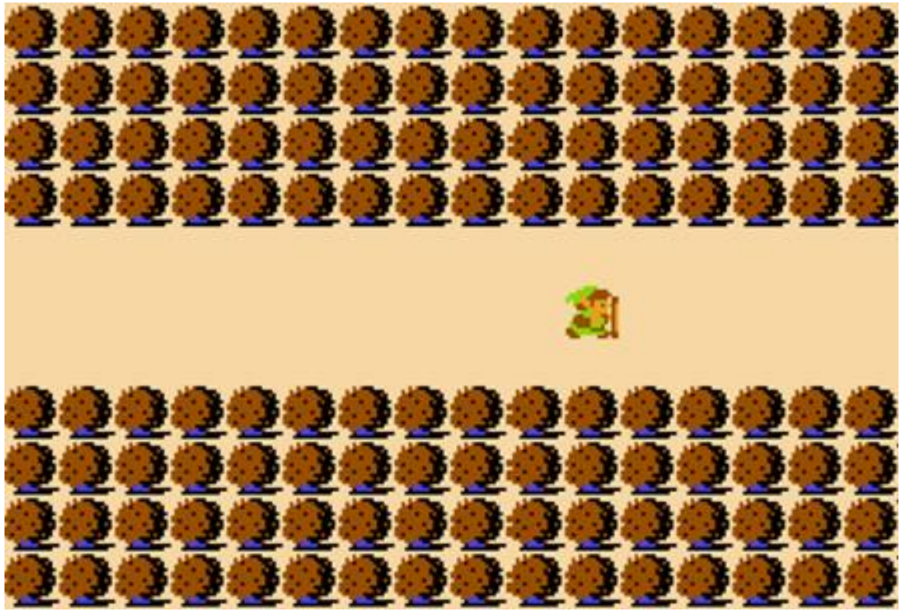
```
if <exit right>:
    <set background to woods_background>
    if <exit right>:
        <set background to woods_background>
        if <exit right>:
            <set background to woods_background>
            and so on and on and on...
        else:
            <set background to exit_background>
    else:
        <set background to exit_background>
else:
    <set background to exit_background>
```



- Legend of Zelda –Lost Woods
- keep going right, takes you back to this same screen, stuck in a loop

```
while <exit right>:
    <set background to woods_background>
<set background to exit_background>
```

CONTROL FLOW: `while` LOOPS

```
while <condition>:
    <expression>
    <expression>
    ...
```

- `<condition>` evaluates to a Boolean
- if `<condition>` is `True`, do all the steps inside the while code block
- check `<condition>` again
- repeat until `<condition>` is `False`

`while` LOOP EXAMPLE

```
You are in the Lost Forest.
************
************
  ☺
************
************
Go left or right?
```

PROGRAM:

```
n = input("You're in the Lost Forest. Go left or right? ")
while n == "right":
    n = input("You're in the Lost Forest. Go left or right? ")
print("You got out of the Lost Forest!")
```

CONTROL FLOW: `while` and `for` LOOPS

- iterate through numbers in a sequence

```
# more complicated with while loop
n = 0
while n < 5:
    print(n)
    n = n+1
```

CONTROL FLOW: `while` and `for` LOOPS

- iterate through numbers in a sequence

```
# more complicated with while loop
n = 0
while n < 5:
    print(n)
    n = n+1


# shortcut with for loop
for n in range(5):
    print(n)
```

CONTROL FLOW: `for` LOOPS

```
for <variable> in range(<some_num>):
    <expression>
    <expression>
    ...
```

- each time through the loop, `<variable>` takes a value
- first time, `<variable>` starts at the smallest value
- next time, `<variable>` gets the prev value + 1
- etc.

`range(start,stop)`

- default values are `start = 0` and `step = 1` and optional
- loop until value is `stop - 1`

```
mysum = 0
for i in range(7, 10):
    mysum += i
print(mysum)
```

`range(start,stop,step)`

- default values are `start = 0` and `step = 1` and optional
- loop until value is `stop - 1`

```
mysum = 0
for i in range(7, 10):
    mysum += i
print(mysum)
```

```
mysum = 0
for i in range(5, 11, 2):
    mysum += i
print(mysum)
```

`break` STATEMENT

- immediately exits whatever loop it is in
- skips remaining expressions in code block
- exits only innermost loop!

```
while <condition_1>:
    while <condition_2>:
        <expression_a>
        break
        <expression_b>
    <expression_c>
```

`break` STATEMENT

```
mysum = 0
for i in range(5, 11, 2):
    mysum += i
    if mysum == 5:
        break
        mysum += 1
print(mysum)
```

- what happens in this program?

COMPARISON: `for` vs. `while`

`for` loops

- know number of iterations
- can end early via `break`
- uses a counter
- can rewrite a `for` loop using a `while` loop

`while` loops

- unbounded number of iterations
- can end early via `break`
- can use a counter but must initialize before loop and increment it inside loop
- may not be able to rewrite a `while` loop using a `for` loop