

## COMP 141

### Nested Loops



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## Announcements

- Reminder
  - Program 5 has been assigned – due 10/17

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## Nested Loops

- Write a loop to print out “\*\*\*\*\*”
 

```
for j in range(5):
    print('*', end='')
print()
```
- Write code to print out the following.
 

```
*****
for i in range(4):
*****
    for j in range(5):
*****
        print('*', end='')
*****
        print()
```

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## Nested Loops Examples

- Input from file
  - Keep inputting next line and take average of numbers on the line until the line == “
- Want to create a ‘clock’ object that needs to go through every second of every minute of every day
- Iterate through every box in a 2-D grid

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## Nested Loops



```

pix = image.load()
for i in range(photo.width()):
    for j in range(photo.height()):
        red,green,blue = pix[i,j]
        avg = (red+green+blue)//3
        pix[i,j] = (avg, avg, avg)
photo = ImageTk.PhotoImage(image)

```

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## Nested Loops

- Definition - A loop that is inside another loop.
- An inner loop goes through all of its iterations for every single iteration of an outer loop.
- Inner loops complete their iterations faster than outer loops.
- To get the total number of iterations of a nested loop, multiply the number of iterations of all the loops

```

for i in range(4):
    for j in range(5):
        print('*', end='')
    print()

```

Outer loop iterates 4 times.  
Inner loop iterates 5 times.  
Total iterations = 20.

```

*****
*****
*****
*****

```

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## Syntax

```

while expression:
    while expression:
        statement(s)
    statement(s)

```

```

while expression:
    for iterating_var in sequence:
        statement(s)
    statement(s)

```

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## Example 1 – Times Tables

1	2	3	4	5	6	7	8	9	10
2	4	6	8	10	12	14	16	18	20
3	6	9	12	15	18	21	24	27	30
4	8	12	16	20	24	28	32	36	40
5	10	15	20	25	30	35	40	45	50

```

for i in range(1, 6):
    for j in range(1, 11):
        print((i*j), end=' ')
    print()

```

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## Example 2 – Dependent Loops

```
for i in range(1, 8, 3):
    for j in range(8, i, -2):
        print(j, end='')
```

8 6 4 2 8 6 8

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## Example 3 – Prime Numbers

```
i = 2
while i < 100:
    prime = True
    for j in range(2, i):
        if i % j == 0:
            prime = False
            break
    if prime:
        print(i, "is prime")
    i = i + 1
```

2 is prime  
3 is prime  
5 is prime  
7 is prime  
11 is prime  
13 is prime  
17 is prime  
19 is prime  
23 is prime  
29 is prime  
31 is prime  
37 is prime  
41 is prime  
43 is prime  
47 is prime  
53 is prime  
59 is prime  
61 is prime  
67 is prime  
71 is prime  
73 is prime  
79 is prime  
83 is prime  
89 is prime  
97 is prime

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## Example 4 – Clock Example

Print every second of  
every minute of every  
hour in 1 day.

```
0 : 0 : 0
0 : 0 : 1
0 : 0 : 2
0 : 0 : 3
.....
23 : 59 : 57
23 : 59 : 58
23 : 59 : 59
```

```
for hrs in range(0, 24):
    for mins in range(0, 60):
        for secs in range(0, 60):
            print (hrs, ":", mins, ":", secs)
```

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## Writing Nested Loops

Designing nested loops

- Design the outer loop without worrying about what goes inside
- Design what goes inside, ignoring the outer loop.
- Put the pieces together, preserving the nesting.

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## Practice

Modify the Prime Numbers code given in class today (in Box.com folder called `allPrimes.py`) to print out the first 50 prime numbers, rather than just the prime numbers less than 100.

Once you get that working, make your output look like:

```
 2  3  5  7 11 13 17 19 23 29
31 37 41 43 47 53 59 61 67 71
73 79 83 89 97 101 103 107 109 113
127 131 137 139 149 151 157 163 167 173
179 181 191 193 197 199 211 223 227 229
```

Hint: `format(i, '4d')` allows you to format `i` (an integer value) to use exactly 4 digits

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