

COMP 141

Nested Loops



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Announcements

- Reminder
 - Program 5 has been assigned – due 3/19

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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.

```

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

```

6

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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

10

10

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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