CS 110
while-loops

Benjamin Dicken

Announcements

- PA 4
- Advanced Material
- Exam announcements Wednesday

Waiter Earnings

- Write a program that can accept any number of incomes and hours worked
- Report the average weekly pay, and the average hourly wage
- For example . . .

```
How many weeks of work? 2
-------
Week 1 pay: 100
Week 1 hours worked: 10
Week 2 pay: 120
Week 2 hours worked: 12
-------
Your average weekly pay was $110.00
Your average hourly wage was $10.00 per hour
```

```
How many weeks of work? 3
-------
Week 1 pay: 300
Week 1 hours worked: 15
Week 2 pay: 250
Week 2 hours worked: 17
Week 3 pay: 275
Week 3 hours worked: 17
-------
Your average weekly pay was $275.00
Your average hourly wage was $16.84 per hour
```

```
How many weeks of work? 4
-------
Week 1 pay: 250
Week 1 hours worked: 15
Week 2 pay: 300
Week 2 hours worked: 17
Week 3 pay: 275
Week 3 hours worked: 15
Week 4 pay: 225
Week 4 hours worked: 12
-------
Your average weekly pay was $262.50
Your average hourly wage was $17.80 per hour
```

The while loop

- A **while** loop allows a programmer to repeat code
- You can think of it as an if-statement with the potential to repeat

```
statements . . .

while conditionA:
    statementA
    statementB
    . . .
    statementN

statements . . .
```

Activity

How many times will print be called?

```
number = 15

while number < 50:
    print('number is less than 50')
```

The while loop

- What if the condition never evaluates to **False**?
  - Possibly an infinite loop!
  - There are some cases where infinite loops are OK, some not
- There are two ways around this:
  - **Break** (do not use in this class!)
  - Designing the code such that the condition will eventually become **False**

Activity

How many times will print be called?

```python
number = 15
counter = 0

while number < counter:
    print('Number is less than 50')
    counter = counter + 2
```

Activity

How many times will print be called?

```
value_1 = 25
value_2 = 10

while value_1 >= value_2:
    print('Print!')
    value_1 = value_1 + 1
    value_2 += 3
```

Activity

How many times will print be called?

```python
value_1 = 15
value_2 = 10
value_3 = 5

while value_1 >= value_2 or value_3 < 20:
    print('Again!')
    value_1 = value_1 + 1
    value_2 += 2
    value_3 += 3
```

Index variable

- One technique that can be used to control the number of loop iterations is using an **index** variable
- For while-loops, an **index** variable is:
    - (1) Defined before the loop
    - (2) Used in the condition of the loop
    - (3) Incremented within the loop

Index variable

```
index = 0

while index < 10:
    print('Print', index)
    # Can add other lines here too
    index = index + 1
```

Index variable

```python
index = 0

while index < 10:
    print('Print', index)
    # Can add other lines here too
    index += 1
```

Activity

Index variable

- How many times will the **while condition** be evaluated (line 2) ?
- How many times will the **index** variable change (lines 5, 7) ?

```
1   index = 0
2   while index < 17:
3       if index % 2 == 0:
4           print('Will add 2 to index')
5           index += 2
6       print('Will add 1 to index')
7       index += 1
```

Activity

Index variable

- How many times will the **while condition** be evaluated (line 2) ? **10**
- How many times will the **index** variable change (lines 5, 7) ?

```
1  index = 0
2  while index < 17:
3      if index % 2 == 0:
4          print('Will add 2 to index')
5          index += 2
6      print('Will add 1 to index')
7      index += 1
```

Activity

Index variable

- How many times will the **while condition** be evaluated (line 2) ? **10**
- How many times will the **index** variable change (lines 5, 7) ? **14**

```
1  index = 0
2  while index < 17:
3      if index % 2 == 0:
4          print('Will add 2 to index')
5          index += 2
6      print('Will add 1 to index')
7      index += 1
```

Waiter Earnings

Where to begin?

```python
weeks = int(input('How many weeks of work? '))
print('-------')
```

```python
weeks = int(input('How many weeks of work? '))
print('-------')


# More goes here ?


average_weekly_pay = ?
average_hourly_wage = ?


print('-------')
print('Your average weekly pay was $' + format(average_weekly_pay, ',.2f'))
print('Your average hourly wage was $' + format(average_hourly_wage, ',.2f') + ' per hour')
```

```python
weeks = int(input('How many weeks of work? '))
print('-------')

total_pay = 0
total_hours = 0

# What goes here?

average_weekly_pay = total_pay / weeks
average_hourly_wage = total_pay / total_hours

print('-------')
print('Your average weekly pay was $' + format(average_weekly_pay, ',.2f'))
print('Your average hourly wage was $' + format(average_hourly_wage, ',.2f') + ' per hour')
```

Activity

```
weeks = int(input('How many weeks of work? '))
print('-------')

total_pay = 0
total_hours = 0

# What goes here?

average_weekly_pay = total_pay / weeks
average_hourly_wage = total_pay / total_hours

print('-------')
print('Your average weekly pay was $' + format(average_weekly_pay, ',.2f'))
print('Your average hourly wage was $' + format(average_hourly_wage, ',.2f') + ' per hour')
```

Implement the missing part!

```python
weeks = int(input('How many weeks of work? '))
print('--------')

total_pay = 0
total_hours = 0

index = 1
while index <= weeks:
    pay = int(input('Week ' + str(index) + ' pay: '))
    hours = int(input('Week ' + str(index) + ' hours worked: '))
    total_pay += pay
    total_hours += hours
    index += 1

average_weekly_pay = total_pay / weeks
average_hourly_wage = total_pay / total_hours

print('--------')
print('Your average weekly pay was $' + format(average_weekly_pay, ',.2f'))
print('Your average hourly wage was $' + format(average_hourly_wage, ',.2f') + ' per hour')
```

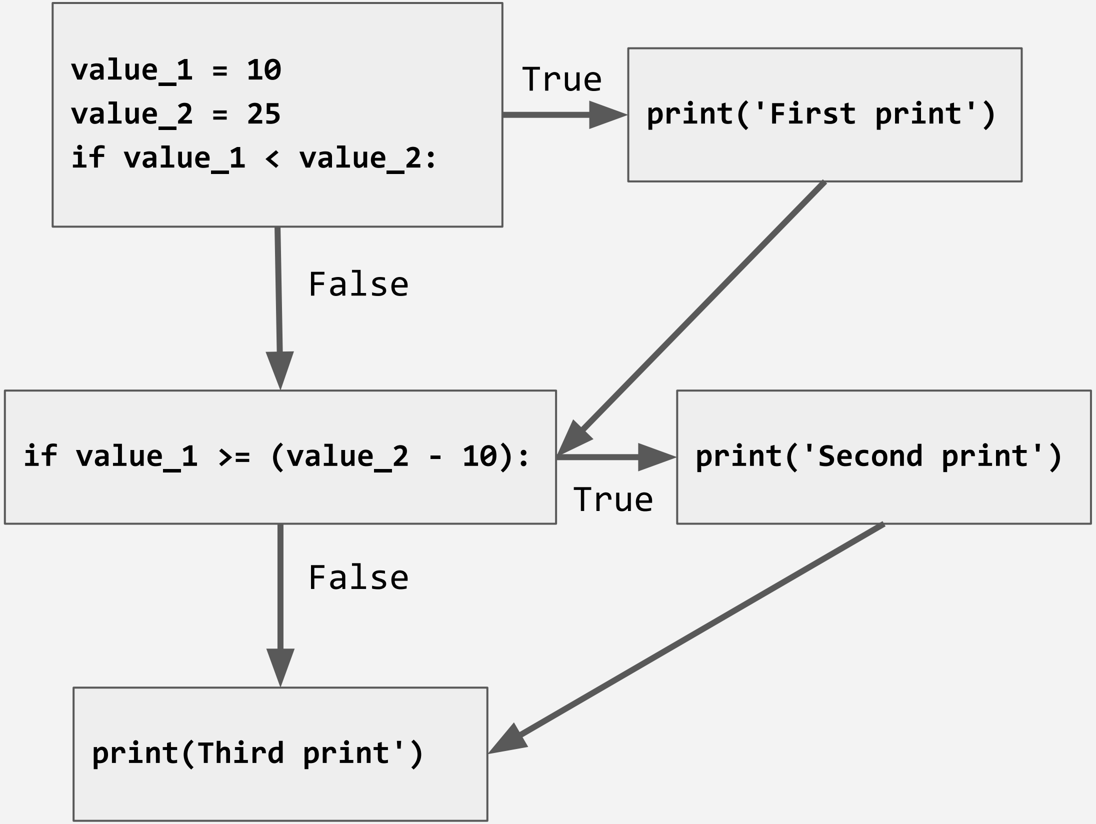
Recall: Control-Flow Graph

```python
value_1 = 10
value_2 = 25

if value_1 < value_2:
    print('First print')

if value_1 >= (value_2 - 10):
    print('Second print')

print('Third print')
```



```
value_1 = 10
value_2 = 25
if value_1 < value_2:
```

```
print('First print')
```

```
if value_1 >= (value_2 - 10):
```

```
print('Second print')
```

```
print(Third print')
```

Activity

Draw the CFG

```
. . .
total_pay = 0
total_hours = 0

index = 1
while index <= weeks:
    pay = int(input('Week ' + str(index) + ' pay: '))
    hours = int(input('Week ' + str(index) + ' hours worked: '))
    total_pay += pay
    total_hours += hours
    index += 1

average_weekly_pay = total_pay / weeks
average_hourly_wage = total_pay / total_hours
. . .
```