Control flow: if statements

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Making decisions

• How do we compute absolute value?

Absolute value of 5 is
Absolute value of 0 is
Absolute value of -22 is

If the value is negative, negate it. Otherwise, use the original value.
Absolute value solution

If the value is negative, negate it. Otherwise, use the original value.

```python
val = -10

# calculate absolute value of val
if val < 0:
    result = -val
else:
    result = val

print(result)
```

In this example, `result` will always be assigned a value.
Absolute value solution

If the value is negative, negate it.
Otherwise, use the original value.

```
val = -10

# calculate absolute value of val
if val < 0:
    result = -val
else:
    result = val

print(result)
```

Another approach that does the same thing without using `result`:

```
val = -10

if val < 0:
    print(-val)
else:
    print(val)
```

In this example, `result` will always be assigned a value.
Absolute value solution

As with loops, a sequence of statements could be used in place of a single statement:

```python
val = -10

# calculate absolute value of val
if val < 0:
    result = -val
    print("val is negative!")
    print("I had to do extra work!")
else:
    result = val
    print("val is positive")
print(result)
```

See in python tutor
val = 0

# calculate absolute value of val
if val < 0:
    print("val is negative")
    print(val)
    result = -val
elif val == 0:
    print("val is zero")
    print(val)
    result = val
else:
    print("val is positive")
    print(val)
    result = val

print(result)
Another absolute value solution

What happens here?

```python
val = 5

# calculate absolute value of val
if val < 0:
    result = -val
    print("val is negative!")
else:
    for i in range(val):
        print("val is positive!")
    result = val

print(result)
```

Another if

It is **not required** that anything happens...

```python
val = -10

if val < 0:
    print("negative value!")
```

What happens when `val = 5`?
The if body can be any statements

```python
# height is in km
if height > 100:
    print("space")
else:
    if height > 50:
        print("mesosphere")
    else:
        if height > 20:
            print("stratosphere")
        else:
            print("troposphere")
```

Execution gets here only if “height > 100” is false AND “height > 50” is true.
# height is in km
if height > 100:
    print("space")
else:
    if height > 50:
        print("mesosphere")
    else:
        if height > 20:
            print("stratosphere")
        else:
            print("troposphere")
# height is in km
if height > 100:
    print("space")
else:
    if height > 50:
        print("mesosphere")
    else:
        if height > 20:
            print("stratosphere")
        else:
            print("troposphere")
Version 2

```python
if height > 50:
    if height > 100:
        print("space")
    else:
        print("mesosphere")
else:
    if height > 20:
        print("stratosphere")
    else:
        print("troposphere")
```

See in python tutor
ONE of the print statements is guaranteed to execute: whichever condition it encounters **first** that is true
Order Matters

# version 3
if height > 100:
    print("space")
elif height > 50:
    print("mesosphere")
elif height > 20:
    print("stratosphere")
else:
    print("troposphere")

# broken version 3
if height > 20:
    print("stratosphere")
elif height > 50:
    print("mesosphere")
elif height > 100:
    print("space")
else:
    print("troposphere")

Try height = 72 on both versions, what happens?
# incomplete version 3

```python
if height > 100:
    print("space")
elif height > 50:
    print("mesosphere")
elif height > 20:
    print("stratosphere")
```

In this case it is possible that nothing is printed at all, when?

In the image, the graph shows the altitudes for the different atmospheric layers:
- Troposphere: 0 to 20 km
- Stratosphere: 20 to 50 km
- Mesosphere: 50 to 90 km
- Space: 90 km and above

It is possible that nothing is printed at all when the height is between 0 and 20 km, as the troposphere is the layer where most of the Earth's atmosphere is concentrated and the instructions for printing are not executed within this range.
What Happens Here?

```python
# height is in km
if height > 100:
    print("space")
if height > 50:
    print("mesosphere")
if height > 20:
    print("stratosphere")
else:
    print("troposphere")
```

Try height = 72
The then clause or the else clause is executed

```python
speed = 54
limit = 55
if speed <= limit:
    print("Good job!")
else:
    print("You owe $", speed/fine)
```

What if we change speed to 64?