Control flow : if statements

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UW CSE 160
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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.

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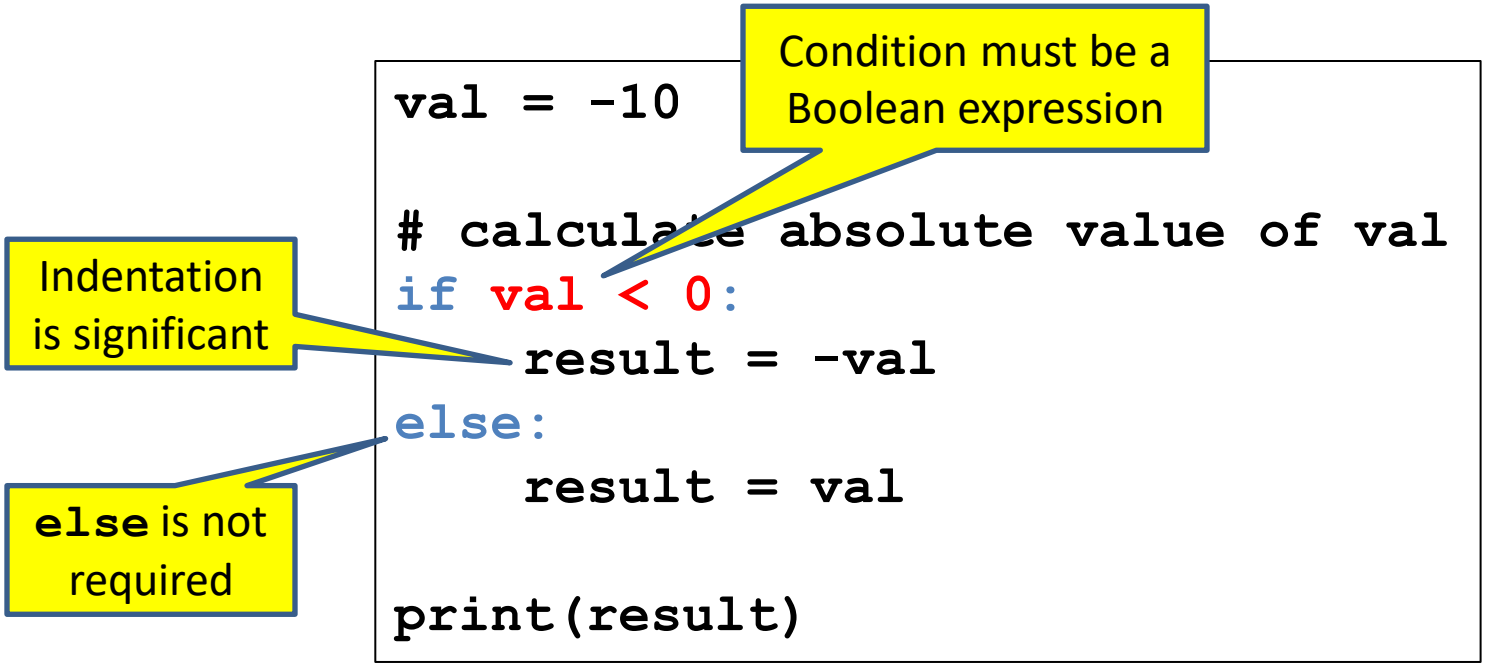
Absolute value solution

If *the value is negative*, negate it.

Otherwise, use the original value.



In this example, **result** will always be assigned a value.

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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.

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Absolute value solution

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

```
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)
```

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Absolute value solution with zero

```
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)
```

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Another if

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

```
val = -10

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

What happens when val = 5?

Another absolute value solution

What happens here?

```
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)
```

The if body can be any statements

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

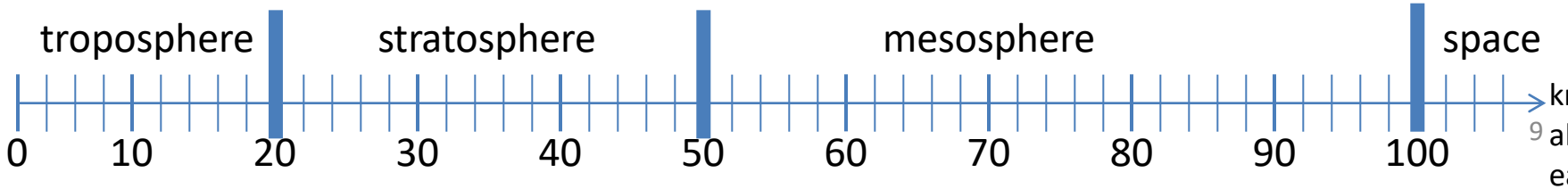
then clause

else clause

Execution gets here only if "height > 100" is false

Execution gets here only if "height > 100" is false AND "height > 50" is true

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



Version 1

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

then clause

else clause

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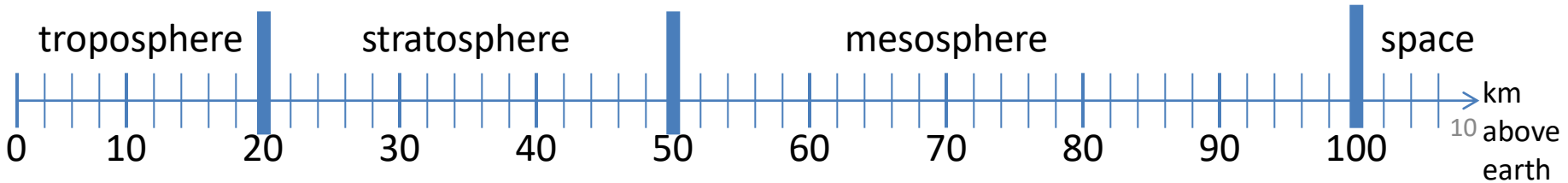
Execution gets here only if "height <= 100" is true

Execution gets here only if "height <= 100" is true AND "height > 50" is true



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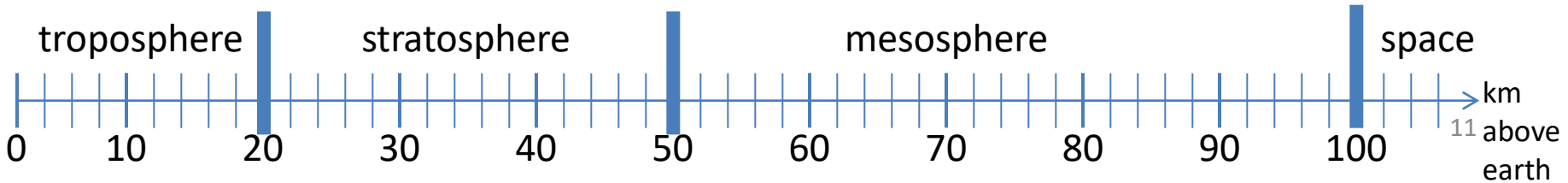
Version 1

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



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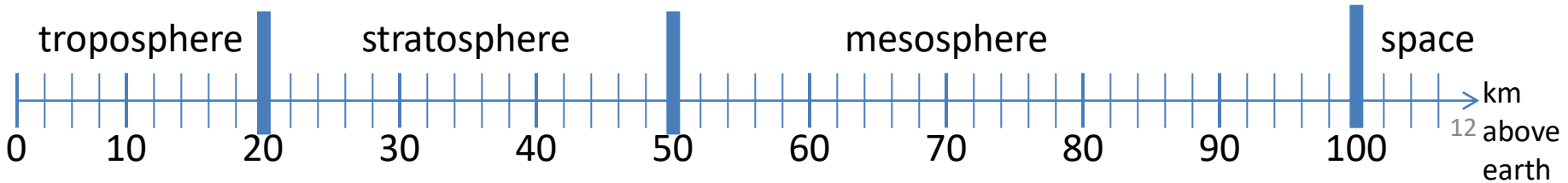
Version 2

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



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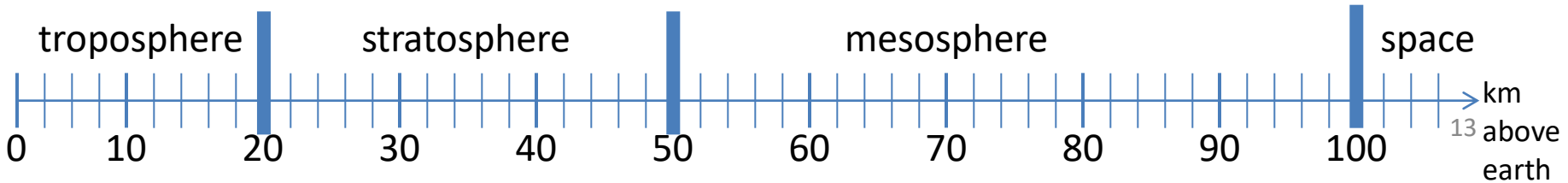
Version 3 (Best)

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

ONE of the print statements is guaranteed to execute:
whichever condition it encounters **first** that is true



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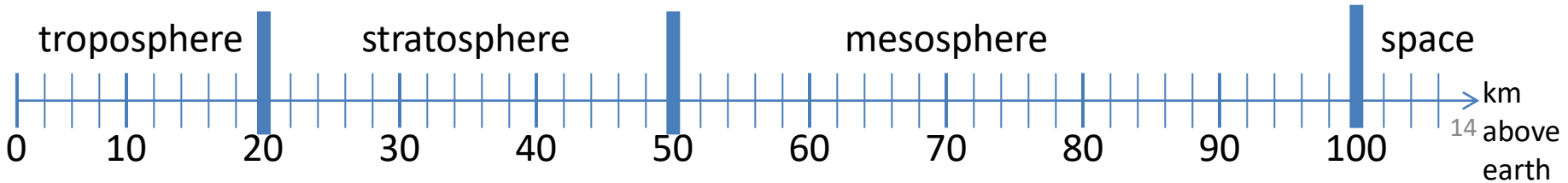
Order Matters

```
# 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?



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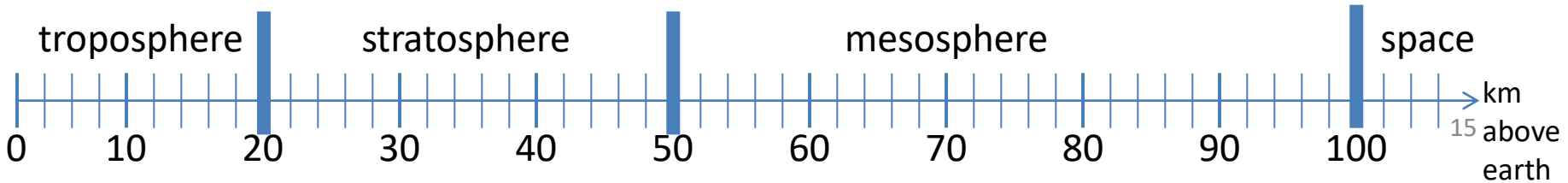
Incomplete Version 3

```
# incomplete version 3
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?



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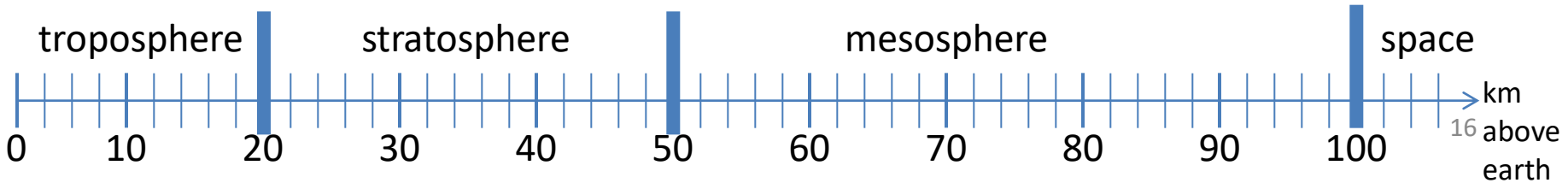
What Happens Here?

```
# 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

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

What if we change speed to 64?