



# 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.

```
val = -10  
  
# calculate absolute value of val  
if val < 0:  
    result = -val  
else:  
    result = val  
  
print(result)
```

Condition must be a Boolean expression

Indentation is significant

else is not required

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.

# Another 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)
```

# Nested if statements

```
val = 0

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

# Use `elif` instead of nested `ifs`

```
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)
```

Easier to read than nested if.  
Equivalent to code on  
previous slide.

# Only `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")

```

```

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

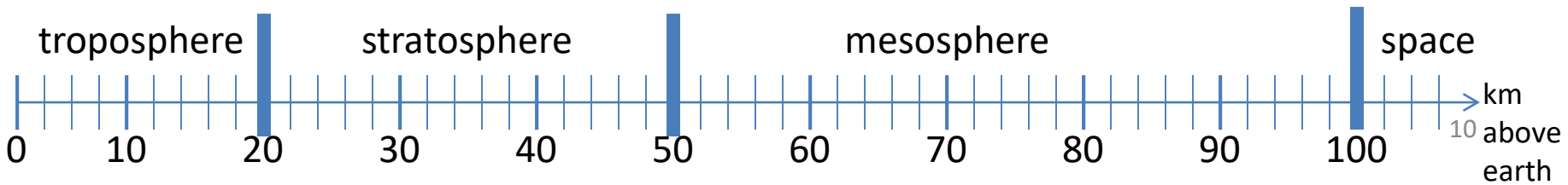
```

if 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



# Version 1

```
# height is in km
```

```
if height > 100:
```

if  
clause

```
    print("space")
```

```
else:
```

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

```
    if height > 50:
```

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

```
        print("mesosphere")
```

```
    else:
```

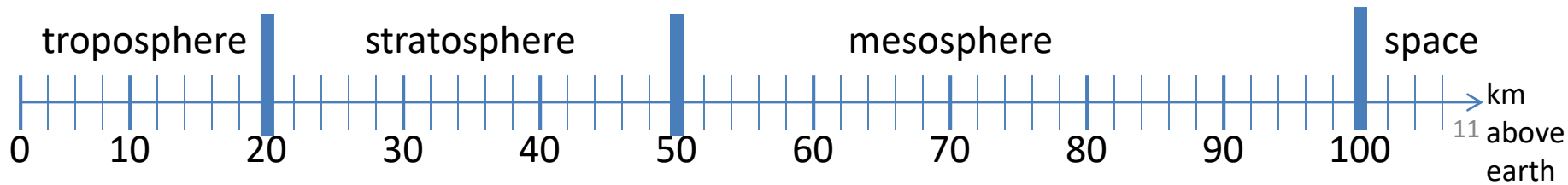
else  
clause

```
        if height > 20:
```

```
            print("stratosphere")
```

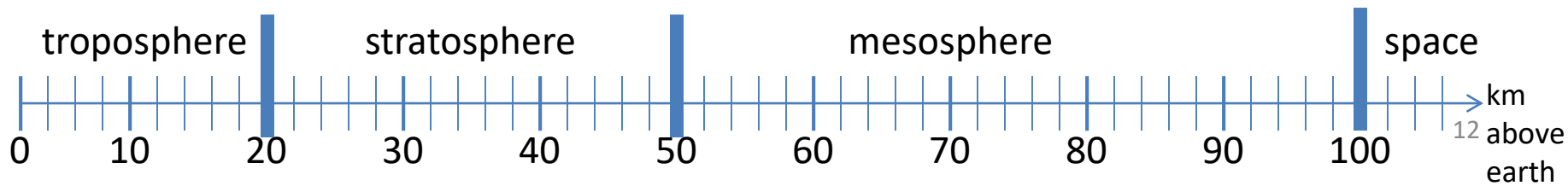
```
        else:
```

```
            print("troposphere")
```



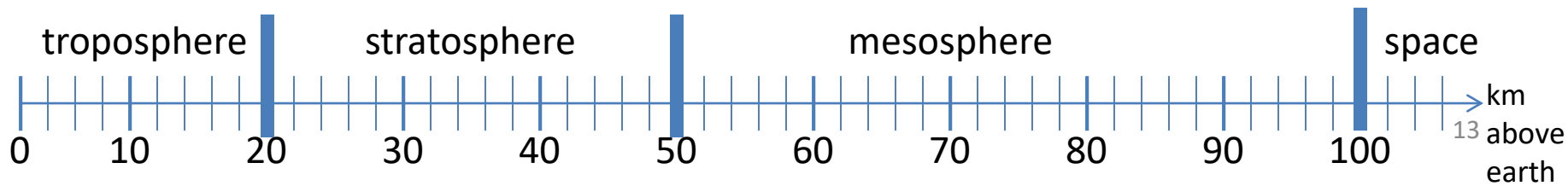
# Version 1

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



# Version 2

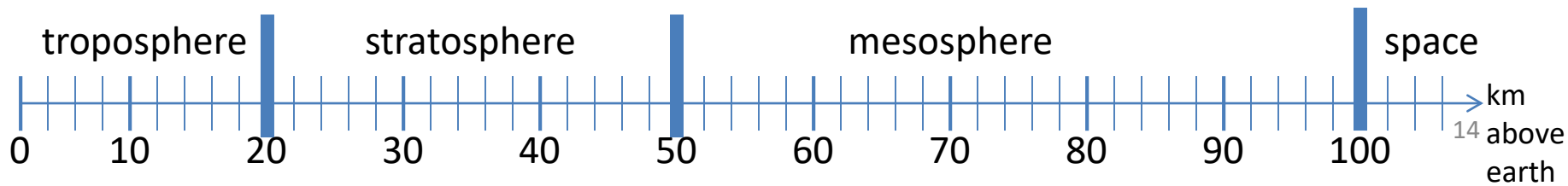
```
if height > 50:
    if height > 100:
        print("space")
    else:
        print("mesosphere")
else:
    if height > 20:
        print("stratosphere")
    else:
        print("troposphere")
```



# 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

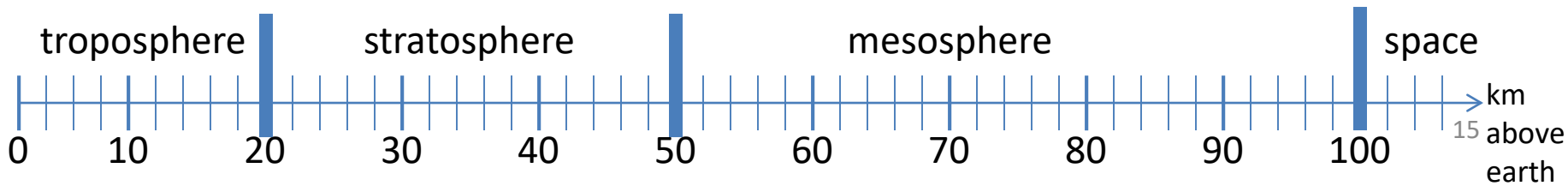


# Order Matters

```
# 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")
```

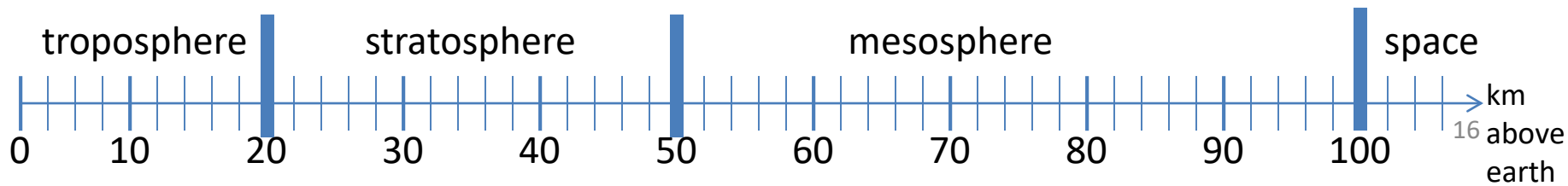
Try height = 72 on both versions, what happens?



# Incomplete Version 3

```
# 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?

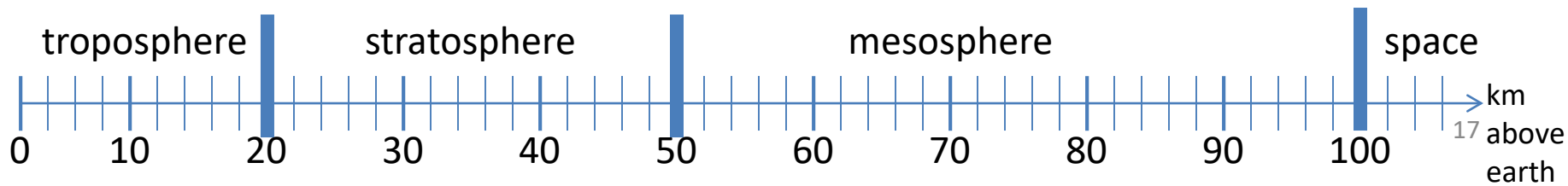




# What Happens Here?

```
# 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

[See in python tutor](#)

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

What if we change speed to 64?