

Python - Week 3



Mohammad Shokoohi-Yekta



Objective

- To solve mathematic problems by using the functions in the **math** module
- To represent and process strings and characters
- To use the + operator to concatenate strings
- To write Boolean expressions by using comparison operators
- To implement selection control by using one-way **if** statements
- To implement selection control by using two-way **if .. else** statements
- To avoid common errors in **if** statements
- To combine conditions by using logical operators (**and**, **or**, and **not**)
- To use selection statements with combined conditions



Built-in functions

```
>>> max(2, 3, 4) # Returns the maximum number  
4  
>>> min(2, 3, 4) # Returns the minimum number  
2  
>>> round(3.51) # Rounds to its nearest integer  
4  
>>> round(3.4) # Rounds to its nearest integer  
3  
>>> abs(-3) # Returns the absolute value  
3  
>>> pow(2, 3) # Same as 2 ** 3  
8
```



String concatenation

You can use the + operator to add two numbers. The + operator can also be used to concatenate (combine) two strings. Here are some examples:

```
>>> message = "Welcome " + "to " + "Python"  
>>> message  
'Weclome to Python'  
>>> chapterNo = 2  
>>> s = "Chapter " + str(chapterNo)  
>>> s  
'Chapter 2'  
>>>
```



Coding Example 1

Ask the user an amount of money in cents and find the least number of coins equivalent to the user's money.

e.g: number of quarters, dimes, nickels and pennies.



Boolean Data Types

There are six comparison operators (also known as relational operators) that can be used to compare two values. The result of the comparison is a Boolean value: true or false.

```
b = (1 > 2)
```



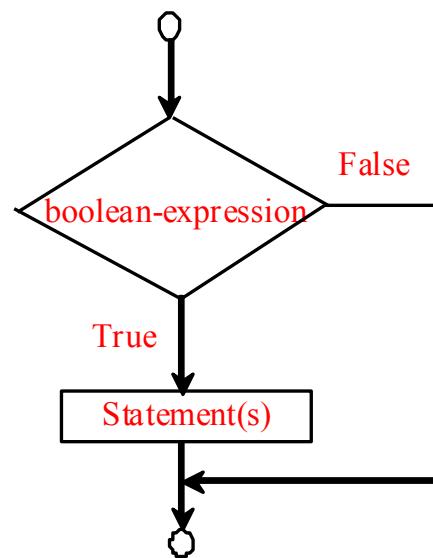
Comparison Operators

<i>Operator</i>	<i>Name</i>
<	less than
<=	less than or equal to
>	greater than
>=	greater than or equal to
==	equal to
!=	not equal to



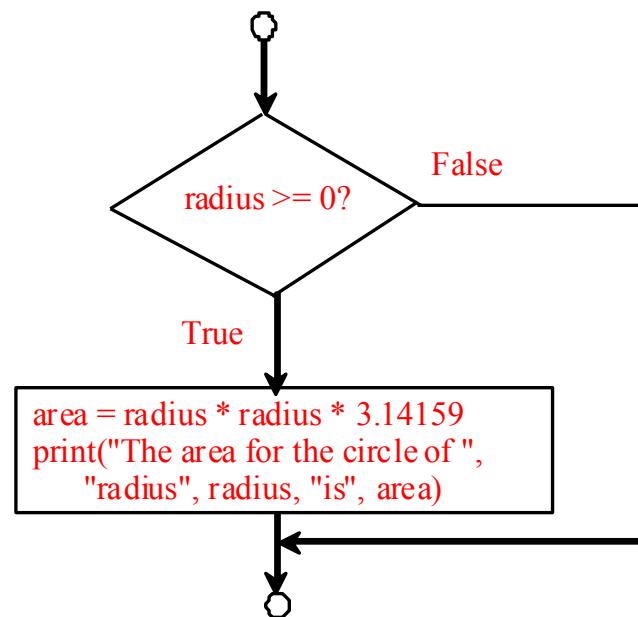
One-way if Statements

if boolean-expression:
statement(s)



(a)

```
if radius >= 0:  
    area = radius * radius * 3.14159  
    print("The area for the circle of radius",  
          radius, "is", area)
```



(b)



Note

```
if i > 0:  
print("i is positive")
```

(a) Wrong

```
if i > 0:  
    print("i is positive")
```

(b) Correct



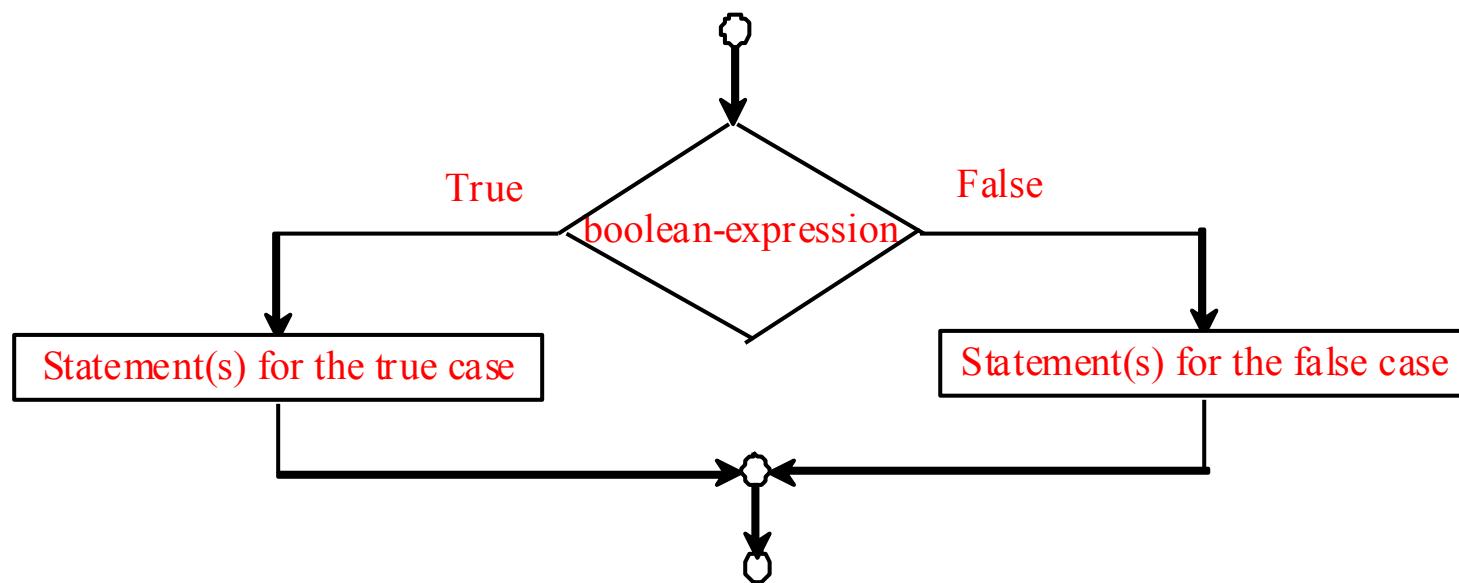
Coding Example 2

Write a program that prompts the user to enter an integer. If the number is a multiple of 5, print HiFive. If the number is divisible by 2, print HiEven.



Two-way if Statement

```
if boolean-expression:  
    statement(s)-for-the-true-case  
else:  
    statement(s)-for-the-false-case
```





if...else Example

```
if radius >= 0:  
    area = radius * radius * math.pi  
    print("The area for the circle of radius", radius, "is", area)  
else:  
    print("Negative input")
```



Multiple Alternative if Statements

```
if score >= 90.0:  
    grade = 'A'  
else:  
    if score >= 80.0:  
        grade = 'B'  
    else:  
        if score >= 70.0:  
            grade = 'C'  
        else:  
            if score >= 60.0:  
                grade = 'D'  
            else:  
                grade = 'F'
```

Equivalent

This is better

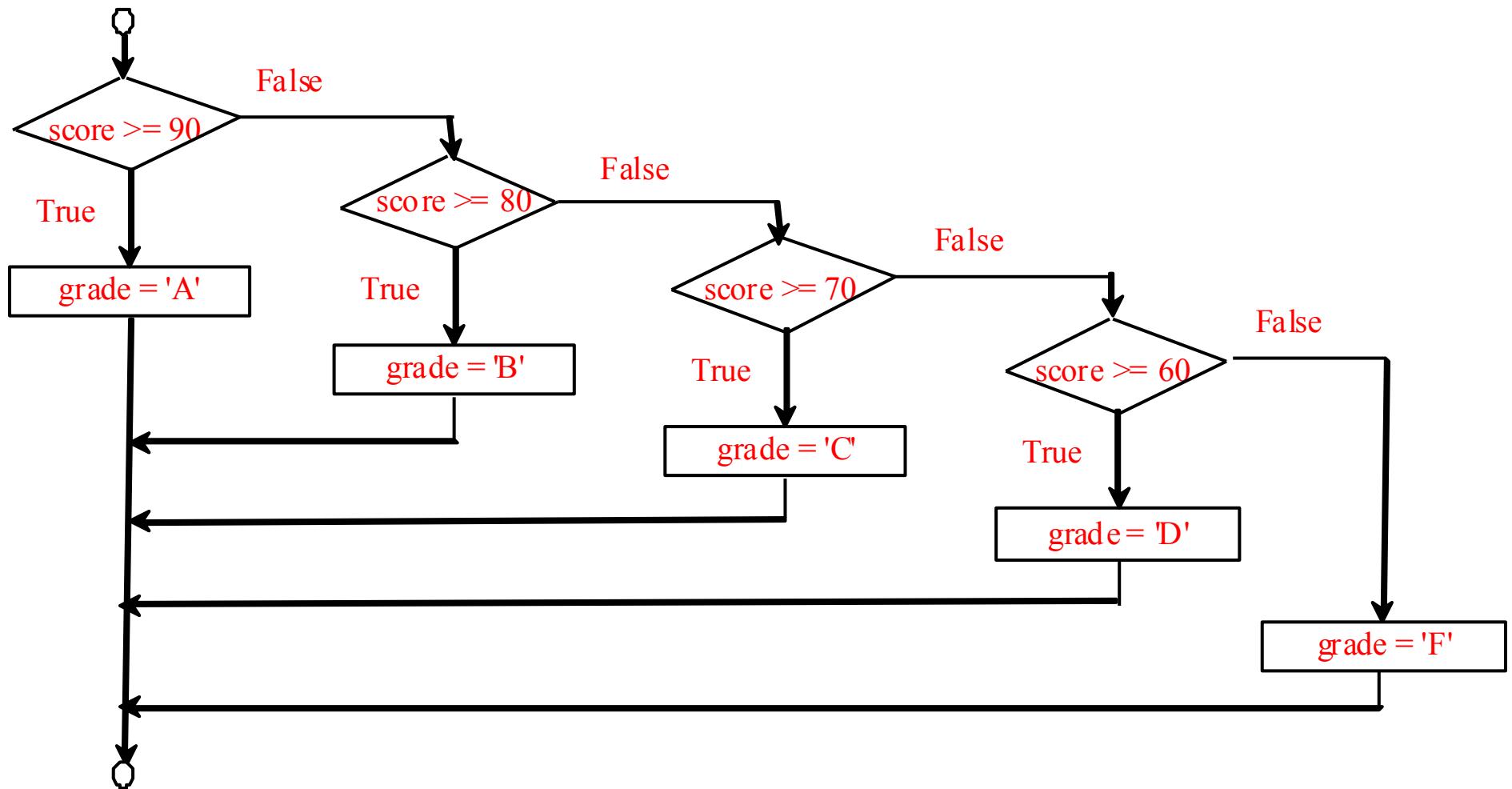
```
if score >= 90.0:  
    grade = 'A'  
elif score >= 80.0:  
    grade = 'B'  
elif score >= 70.0:  
    grade = 'C'  
elif score >= 60.0:  
    grade = 'D'  
else:  
    grade = 'F'
```

(a)

(b)



Flowchart





Trace if-else statement

Suppose score is 70.0

The condition is false

```
if score >= 90.0:  
    grade = 'A'  
elif score >= 80.0:  
    grade = 'B'  
elif score >= 70.0:  
    grade = 'C'  
elif score >= 60.0:  
    grade = 'D'  
else:  
    grade = 'F'
```



Trace if-else statement

Suppose score is 70.0

The condition is false

```
if score >= 90.0:  
    grade = 'A'  
elif score >= 80.0:  
    grade = 'B'  
elif score >= 70.0:  
    grade = 'C'  
elif score >= 60.0:  
    grade = 'D'  
else:  
    grade = 'F'
```



Trace if-else statement

Suppose score is 70.0

The condition is true

```
if score >= 90.0:  
    grade = 'A'  
elif score >= 80.0:  
    grade = 'B'  
elif score >= 70.0:  
    grade = 'C'  
elif score >= 60.0:  
    grade = 'D'  
else:  
    grade = 'F'
```



Trace if-else statement

Suppose score is 70.0

grade is C

```
if score >= 90.0:  
    grade = 'A'  
elif score >= 80.0:  
    grade = 'B'  
elif score >= 70.0:  
    grade = 'C'  
elif score >= 60.0:  
    grade = 'D'  
else:  
    grade = 'F'
```



Trace if-else statement

Suppose score is 70.0

Exit the if statement

```
if score >= 90.0:  
    grade = 'A'  
elif score >= 80.0:  
    grade = 'B'  
elif score >= 70.:  
    grade = 'C'  
elif score >= 60.0:  
    grade = 'D'  
else:  
    grade = 'E'
```



Common Errors

Most common errors in selection statements are caused by incorrect indentation. Consider the following code in (a) and (b).

```
radius = -20

if radius >= 0:
    area = radius * radius * 3.14
print("The area is", area)
```

(a) Wrong

```
radius = -20

if radius >= 0:
    area = radius * radius * 3.14
print("The area is", area)
```

(b) Correct



Tip

```
if number % 2 == 0:  
    even = True  
else:  
    even = False
```

(a)

Equivalent
=====

This is shorter

```
even = number % 2 == 0
```

(b)



Computing Taxes

The US federal personal income tax is calculated based on the filing status and taxable income. There are four filing statuses: single filers, married filing jointly, married filing separately, and head of household. The tax rates for 2009 are shown in the next slide.



Computing Taxes ...

Marginal Tax Rate	Single	Married Filing Jointly or Qualified Widow(er)	Married Filing Separately	Head of Household
10%	\$0 – \$8,350	\$0 – \$16,700	\$0 – \$8,350	\$0 – \$11,950
15%	\$8,351 – \$33,950	\$16,701 – \$67,900	\$8,351 – \$33,950	\$11,951 – \$45,500
25%	\$33,951 – \$82,250	\$67,901 – \$137,050	\$33,951 – \$68,525	\$45,501 – \$117,450
28%	\$82,251 – \$171,550	\$137,051 – \$208,850	\$68,525 – \$104,425	\$117,451 – \$190,200
33%	\$171,551 – \$372,950	\$208,851 – \$372,950	\$104,426 – \$186,475	\$190,201 - \$372,950
35%	\$372,951+	\$372,951+	\$186,476+	\$372,951+



Computing Taxes ...

```
if status == 0:  
    # Compute tax for single filers  
elif status == 1:  
    # Compute tax for married filing jointly  
elif status == 2:  
    # Compute tax for married filing separately  
elif status == 3:  
    # Compute tax for head of household  
else:  
    # Display wrong status
```



Coding Example 3

Body Mass Index: Body Mass Index (BMI) is a measure of health on weight. It can be calculated by taking your weight in kilograms and dividing by the square of your height in meters. The interpretation of BMI for people 16 years or older is as follows:

BMI	Interpretation
Below 18.5	Underweight
18.5–24.9	Normal
25.0–29.9	Overweight
Above 30.0	Obese



Coding Example 3 ...

Write a code which inputs a user's height and weight, then outputs the interpretation of user's BMI



Logical Operators

Operator	Description
not	logical negation
and	logical conjunction
or	logical disjunction



Truth Table for Operator not

p	not p	Example (assume age = 24, gender = 'F')
True	False	not (age > 18) is False, because (age > 18) is True.
False	True	not (gender == 'M') is True, because (grade == 'M') is False.



Truth Table for Operator and

p1	p2	p1 and p2	Example (assume age = 24, gender = 'F')
False	False	False	(age > 18) and (gender == 'F') is True, because (age > 18) and (gender == 'F') are both True.
False	True	False	
True	False	False	(age > 18) and (gender != 'F') is False, because (gender != 'F') is False.
True	True	True	



Truth Table for Operator or

p1	p2	p1 or p2	Example (assume age = 24, gender = 'F')
False	False	False	(age > 34) or (gender == 'F') is true, because (gender == 'F') is True.
False	True	True	
True	False	True	(age > 34) or (gender == 'M') is False, because (age > 34) and (gender == 'M') are both False.
True	True	True	

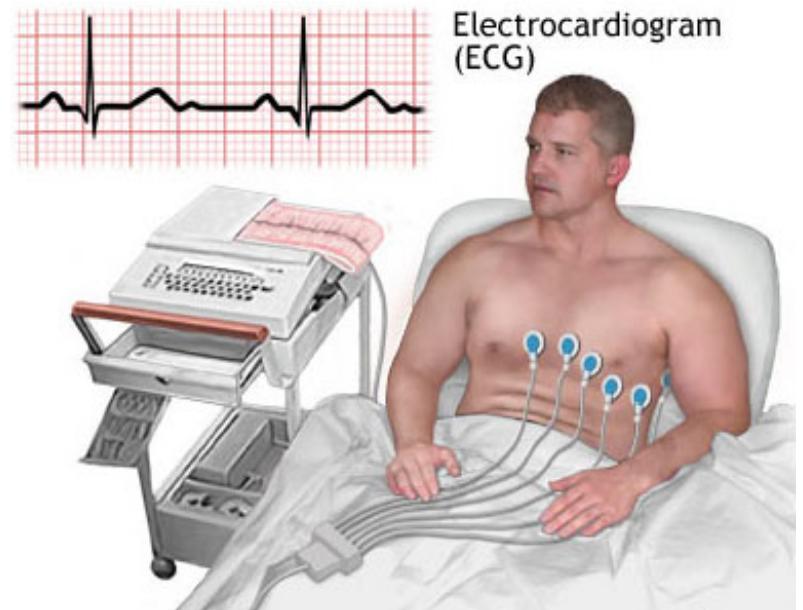
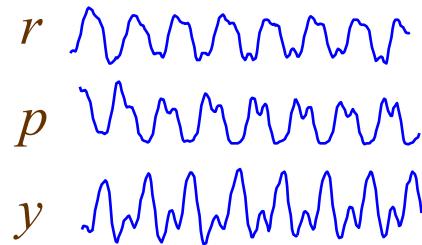
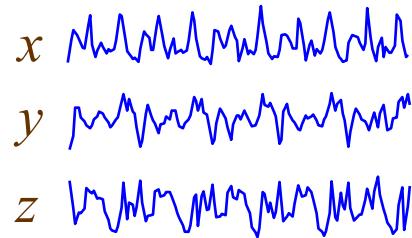


Coding Example 4

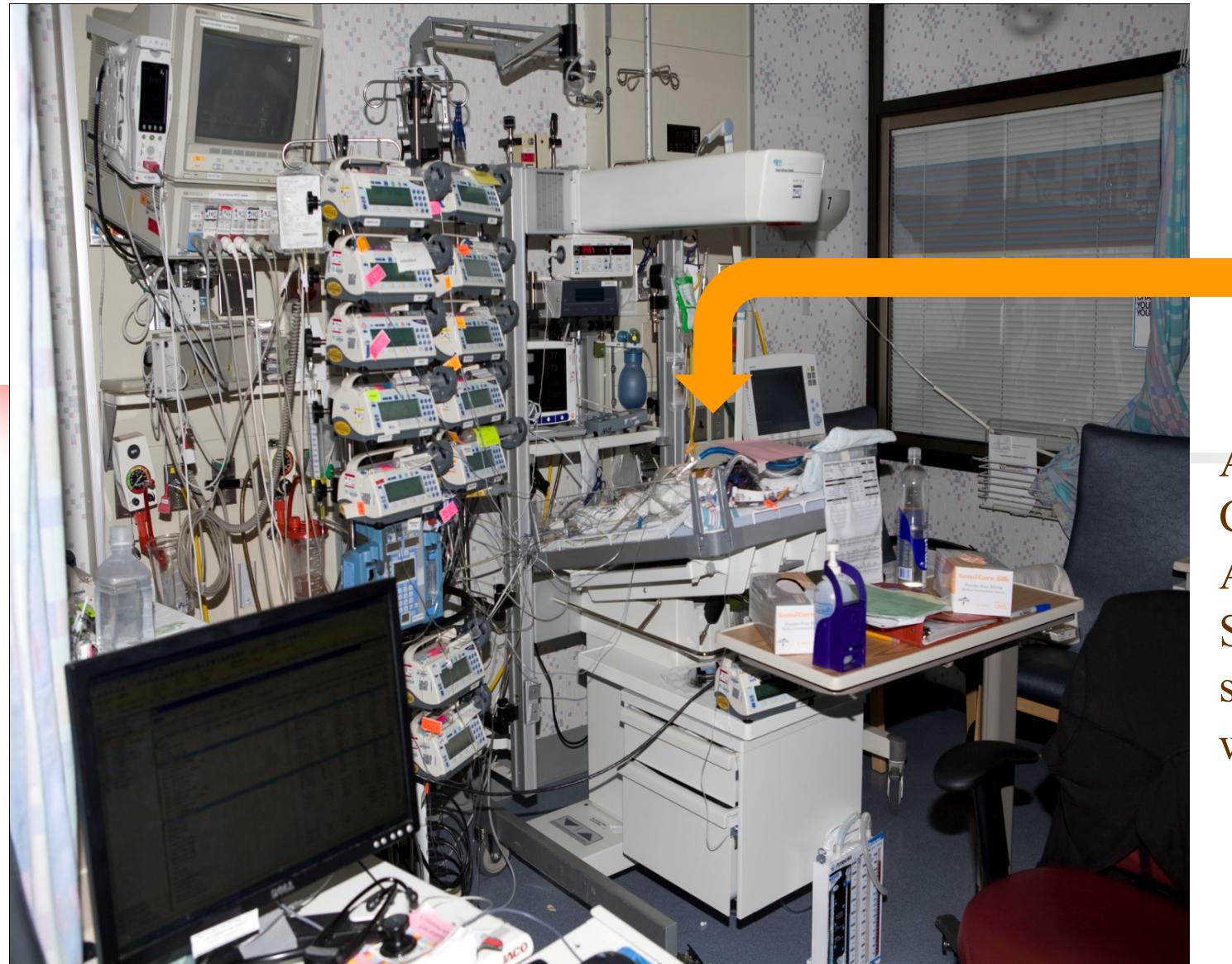
Write a program that checks whether a number is divisible by 2 and 3, whether a number is divisible by 2 or 3, and whether a number is divisible by 2 or 3 but not both.

Data Mining: Prediction Project

What is Time Series Data?



dependence
modifier temperature effect
harvesting several
study controlling interest estimate furthermore
exploratory extent enormously real best
displacement variation
outcome particular concern
confounding primarily source
evidence analysis capacity
typically relationship
health simulation many multi climate
statistical point non analytic
completing many climate
pollution developed datum debate property
method lag air detail control
convincing however subject address series primary
weather 33



A baby in a PICU at
Children's Hospital Los
Angles
She produces 12 time
series, possibly for
weeks..

Why Predict the (short-term) Future?

If a robot can predict that it is about to fall, it may be able to..

- Prevent the fall
- Mitigate the damage of the fall

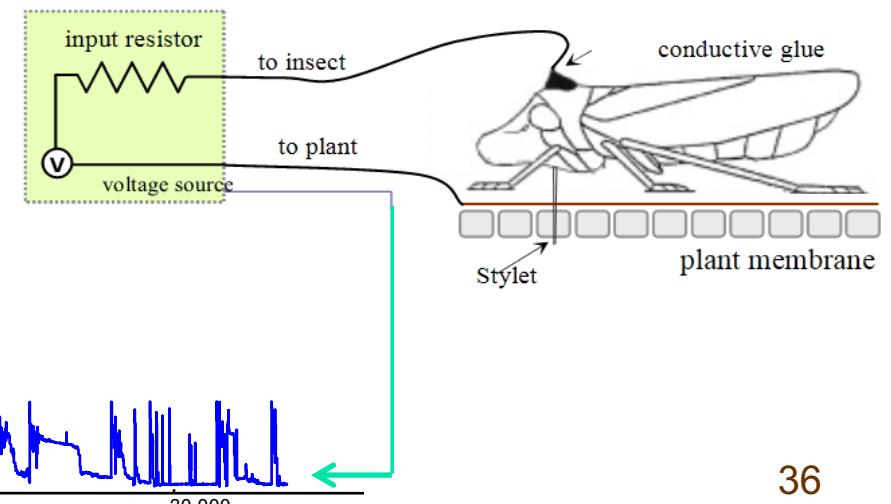
More importantly, if the robot can predict a *human's* actions

- A robot could catch a falling human!
- This would allow more natural human/robot interaction.
- Real time is not fast enough for interaction! It needs to be real time, minus a second.

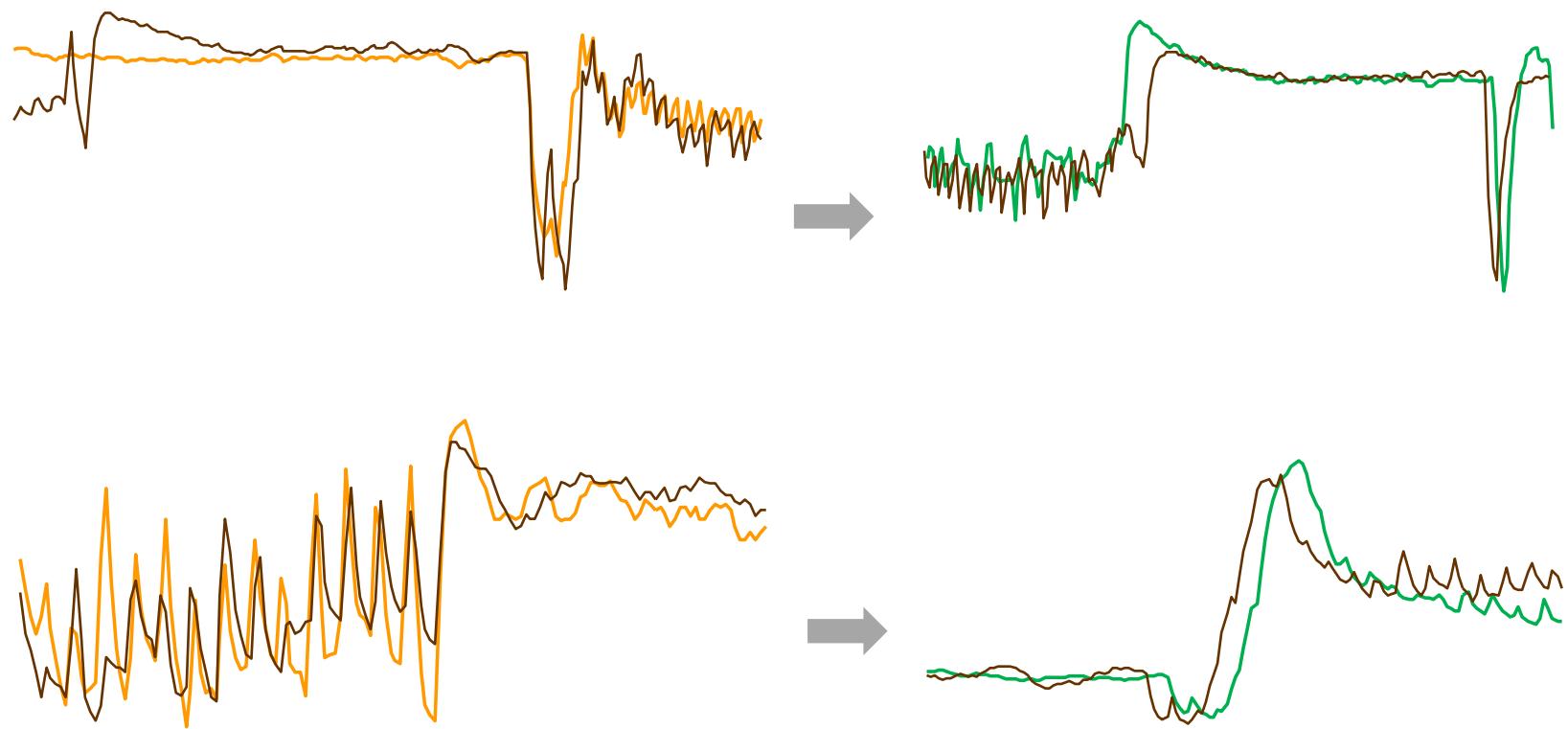




- Leafhoppers suck sap from the leaves cause mottled discoloration
- In Iowa, the potato leafhopper causes \$15 M damage
- Glue a wire to insect to activate the circuit

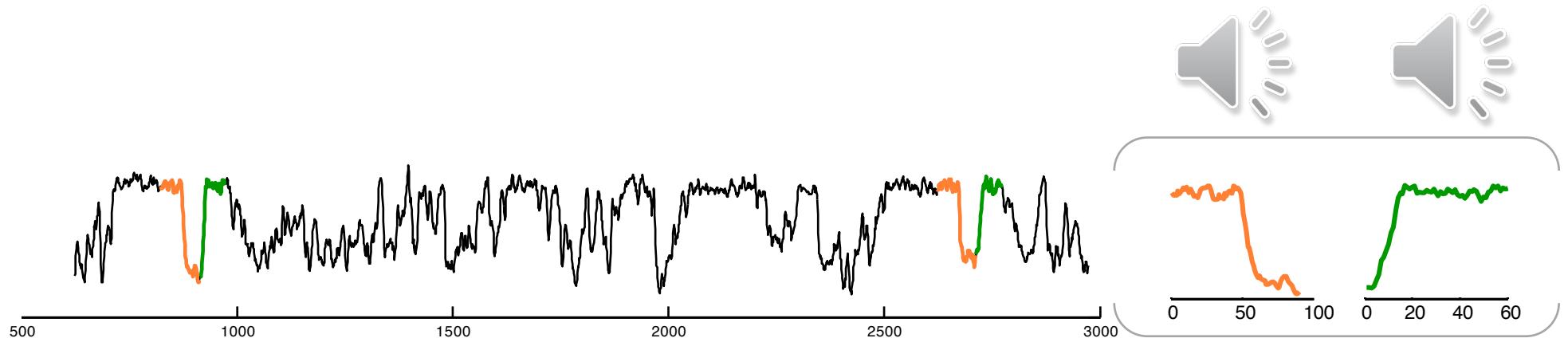


0 10,000 20,000 30,000





Lets consider some Zebra Finch songs (MFCC space)

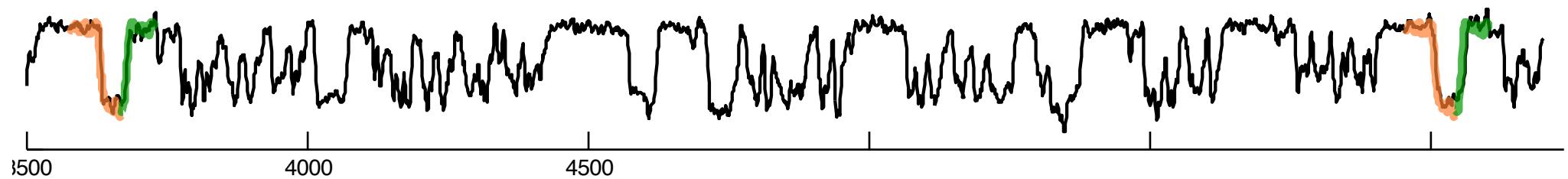
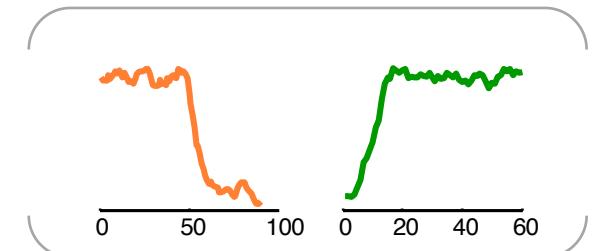


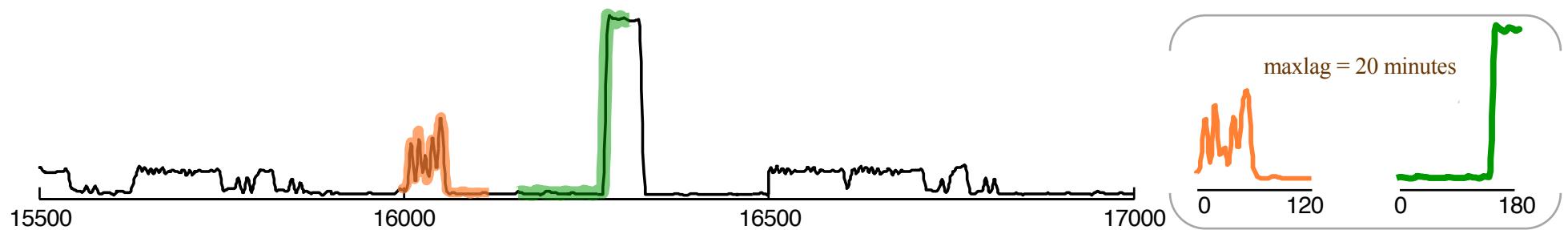
Rule learned on day 40 (post hatch). Lets wait 60 days to see if the rule still applies...



Lets consider some Zebra Finch songs (MFCC space)

The rule firing on the singing of a 100 day old zebra finch





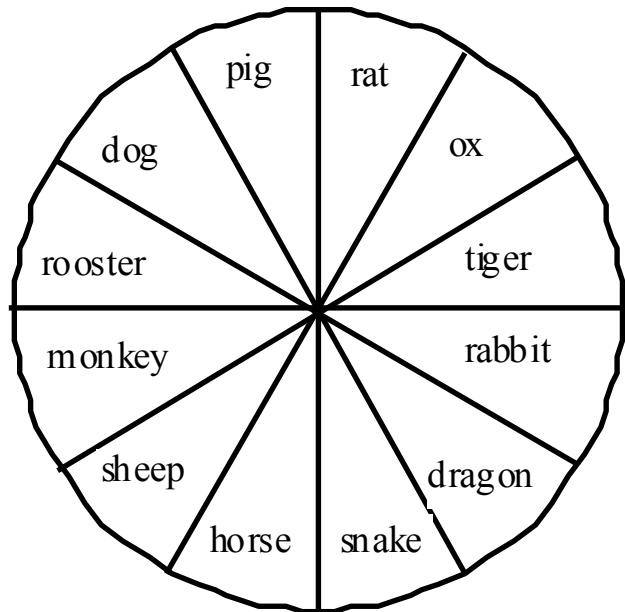
**IF we see a *Clothes Washer used*
THEN we will see *Clothes Dryer used* within 20 minutes**

Lab Works



Lab Work 1

Write a program to find out the Chinese Zodiac sign for a given year. The Chinese Zodiac sign is based on a 12-year cycle, each year being represented by an animal: rat, ox, tiger, rabbit, dragon, snake, horse, sheep, monkey, rooster, dog, and pig, in this cycle.



$$\text{year \% } 12 =$$

- { 0: monkey
1: rooster
2: dog
3: pig
4: rat
5: ox
6: tiger
7: rabbit
8: dragon
9: snake
10: horse
11: sheep }



Lab Work 2

Write a program which first prompts the user to enter a year as an int value and checks if it is a leap year.

A year is a leap year if it **is divisible by 4** but **not by 100**, or it **is divisible by 400**.



C U next week ☺