

# **TCSS 142 – Introduction to Programming**

**Autumn 2014  
Day 04**

# Day 4 Overview

- Truth tables
- Simple if
- Sequential ifs
- Nested ifs
- Float and string comparisons

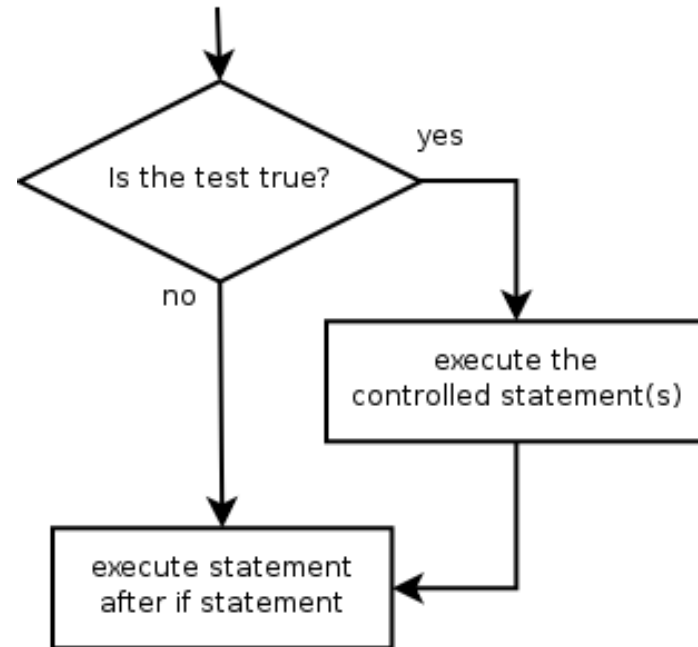
# Truth Tables

- Verify whether  
not (A and B) *and* (not A) or (not B) are  
equivalent  
not A and not B *and* not (A or B) are equivalent
- Verify whether A and B or C *and* not (A or B and  
C) are equivalent

# The `if` statement

*Executes a block of statements only if a test is true*

```
if test:  
    statement  
    ...  
    statement
```



- Example:

```
gpa = float(input("Enter your gpa: "))  
if gpa >= 2.0:  
    print("Application accepted.")
```

# The if statement

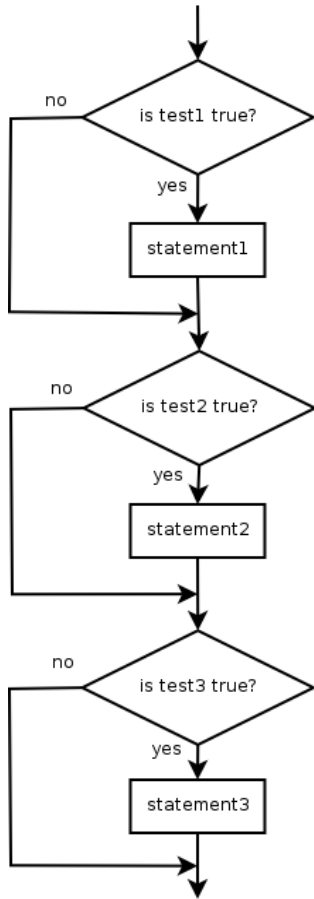
```
gpa = 1.0
if gpa >= 2.0:
    print("Application accepted.")
    print("Good job!")
```

```
gpa = 2.0
if gpa >= 2.0:
    print("Application accepted.")
    print("Good job!")
```

```
gpa = 1.0
if gpa >= 2.0:
    print("Application accepted.")
print("Good job!")
```

# Sequential ifs

- On occasion, you will have a number of tests to perform
  - If these are independent tests - NOT mutually exclusive (one true condition does not preclude another to be true), use sequential ifs



```
if test:  
    statement(s)
```

```
if test:  
    statement(s)
```

```
if test:  
    statement(s)
```

0, 1, or many paths may execute  
*(independent tests; not exclusive)*

# Example

- Taxes

if you have a child under age 17, deduct \$1,000

if you have mortgage, deduct mortgage interest charged by the bank

if you own a car, deduct car registration fee

if you are over 70, deduct \$1,125

if you gave to tax-deductible charities, deduct the amount you gave

# Exercise

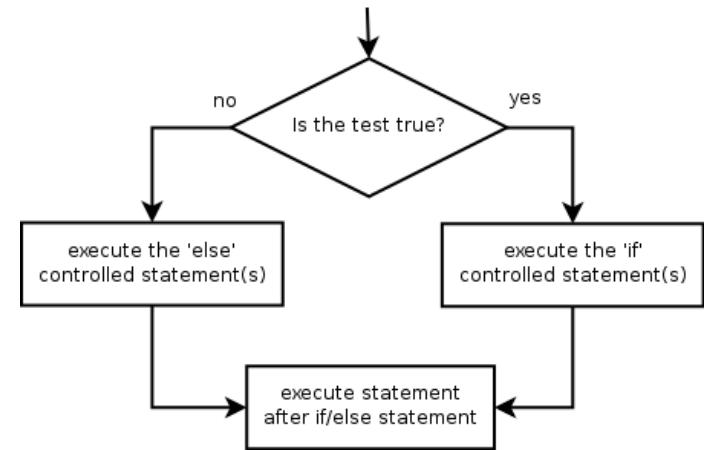
- Write a program called `evens.py` that asks for 3 integers and prints how many of these values are even numbers:
  - How to determine if a number is even?
  - How to keep track of how many of these numbers are even?



# The if/else statement

*Executes one block if a test is true, another if false*

```
if test:  
    statement(s)  
else:  
    statement(s)
```



- **Example:**

```
gpa = float(input("Enter your gpa: "))  
if gpa >= 2.0:  
    print("Welcome to Mars University!")  
else:  
    print("Application denied.")
```

# The if/else statement

```
gpa = 3.0  
if gpa >= 2.0:  
    print("Welcome to Mars University!")  
else:  
    print("Application denied.")
```

```
gpa = 3.0  
if gpa >= 2.0:  
    print("Welcome to Mars University!")  
    else  
        print("Application denied.")
```

```
gpa = 3.0  
if gpa >= 2.0:  
    print("Welcome to Mars University!")  
else:  
    print("Application denied.")  
print("Thank you for applying")
```

# Exercise

Download the program `ifOops.py` from Canvas and fix it. The program is to prompt the user for 2 integer values, compare them, and print whether the first number is smaller or larger than the second one. Finally, `Have a nice day!` should be printed regardless of which value constitutes a larger one.

# Nested ifs

- Typically, the program logic is more complex than a plain if or if-else statement
  - Solution: nesting

```
double gpa = ??
```

```
if gpa >= 2.0:  
    print("Welcome to Mars University!")  
    if gpa >= 3.5:  
        print("You will get a scholarship of $1K")  
    else:  
        print("We are so happy you could join us!")
```

# Nested ifs

```
if gpa >= 2.0:
    print("Welcome to Mars University!")
    if gpa >= 3.5:
        print("You will get a scholarship of $1K")
else:
    print("Application denied")
```

```
if gpa >= 2.0:
    print("Welcome to Mars University!")
if gpa >= 3.5:
    print("You will get a scholarship of $1K")
else:
    print("We are so happy you could join us!")
```

# Example

- Download `ifExample1.py` from Canvas. Add code to calculate and print either area (1) or diameter (2) or circumference (3) of a circle, depending on the user's preference. Use nested `if` and `else`.

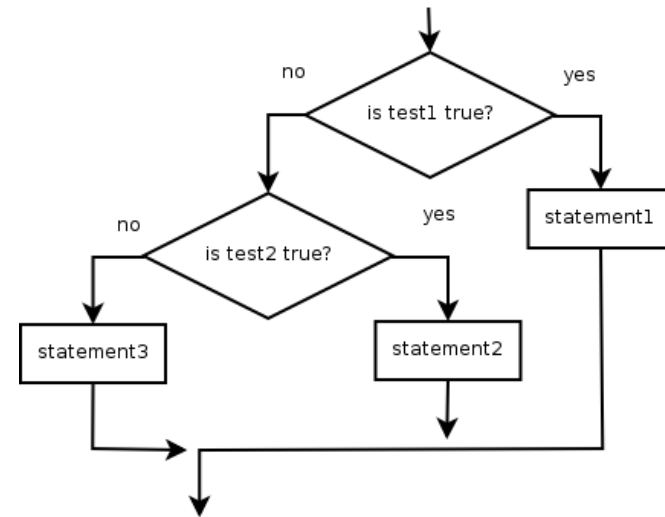
# Nested if/else

*Chooses between outcomes using many tests*

```
if test:  
    statement(s)  
elif test:  
    statement(s)  
else:  
    statement(s)
```

- Example:

```
if x > 0:  
    print("Positive")  
elif x < 0:  
    print("Negative")  
else:  
    print("Zero")
```



# Exercise

- Open `ifExample1.py` and save as `ifExample2.py`, then rewrite the code using  
`if - elif - else`



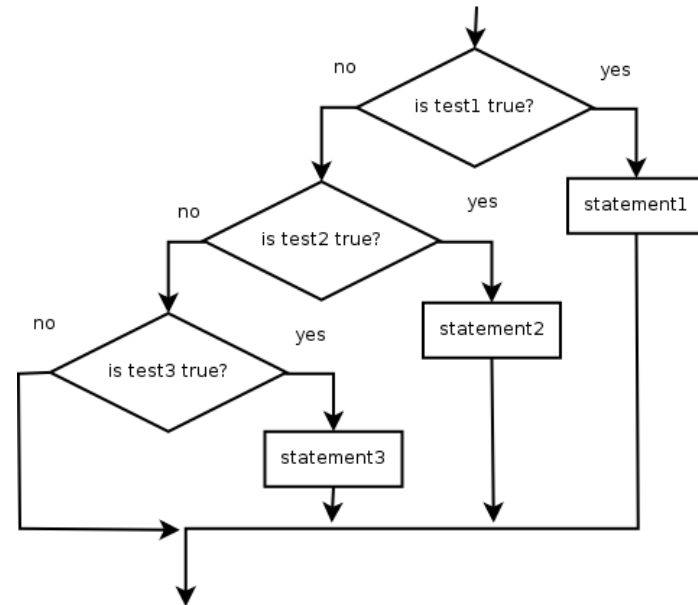
# Nested if/else/if

- If it ends with `else`, exactly one path must be taken.
- If it ends with `if`, the code might not execute any path.

```
if test:  
    statement(s)  
elif test:  
    statement(s)  
elif test:  
    statement(s)
```

- Example:

```
if place == 1:  
    print("Gold medal!")  
elif place == 2:  
    print("Silver medal!")  
elif place == 3:  
    print("Bronze medal.")
```



# Nested if structures

- exactly 1 path (*mutually exclusive*)

```
if test:  
    statement(s)  
elif test:  
    statement(s)  
else:  
    statement(s)
```

- 0 or 1 path (*mutually exclusive*)

```
if test:  
    statement(s)  
elif test:  
    statement(s)  
else if test:  
    statement(s)
```

- 0, 1, or many paths (*independent tests; not exclusive*)

```
if test:  
    statement(s)  
if test:  
    statement(s)  
if test:  
    statement(s)
```

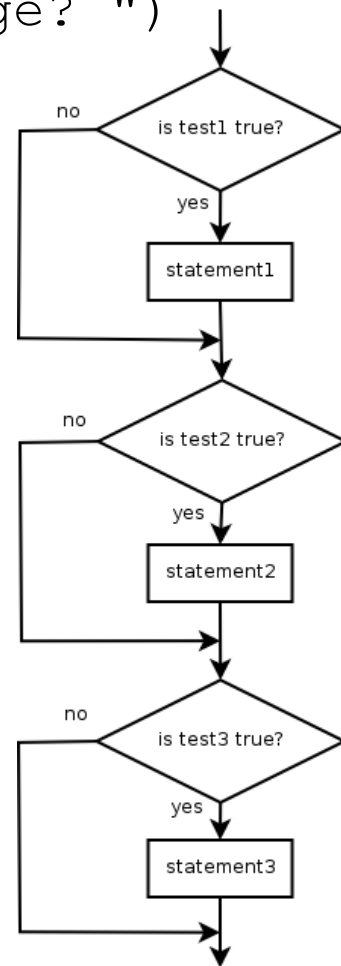
# Example

- Open `ifExample2.py` and save as `ifExample3.py`, then rewrite the code using  
`if - elif - elif`

# Misuse of if

- What's wrong with the following code?

```
percent = float(input("What is your percentage? "))
if percent >= 90:
    print("You got an A!")
if percent >= 80:
    print("You got a B!");
if percent >= 70:
    print("You got a C!")
if percent >= 60:
    print("You got a D!")
if percent < 60:
    print("You got an F!")
if percent < 0:
    print("Invalid input")
...
```



# Fix 1

```
percent = float(input("What is your percentage? "))
if percent >= 90:
    print("You got an A!")
if percent >= 80 and percent < 90:
    print("You got a B!");
if percent >= 70 and percent < 80:
    print("You got a C!")
if percent >= 60 and percent < 70:
    print("You got a D!")
if percent < 60 and percent >= 0:
    print("You got an F!")
if percent < 0:
    print("Invalid input")

...
```

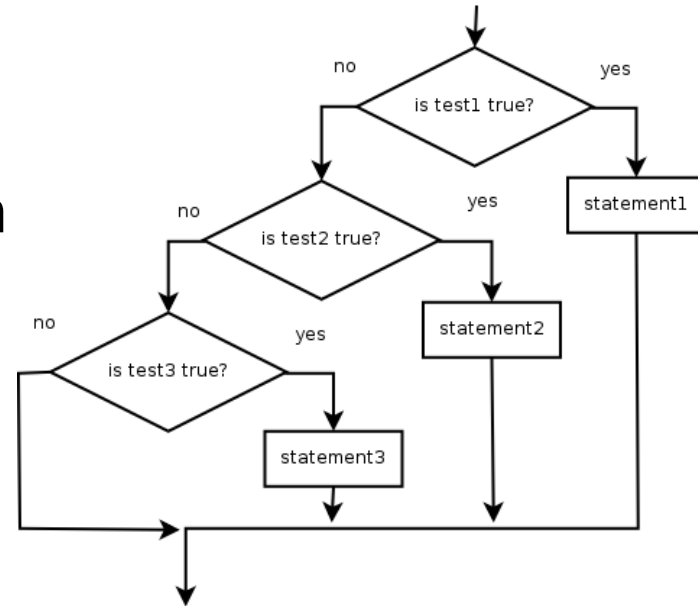
# Fix 2: Better

```
percent = float(input("What is your percentage? "))
if percent >= 90:
    print("You got an A!")
elif percent >= 80:
    print("You got a B!");
elif percent >= 70:
    print("You got a C!")
elif percent >= 60:
    print("You got a D!")
elif percent < 0:
    print("Invalid input")
else:
    print("You got an F!")

...
```

# Testing Ifs

- Testing
  - Cover all independent paths
  - Exercise all logical decisions – condition
  - Cover boundaries and special cases



- Example – what's the problem here?
  - if sales > \$30,000, bonus \$5,000
  - if \$30,000 >= sales > \$25,000, bonus \$2,500
  - if sales < \$25,000, bonus 0

# Test Cases

- The program should be run with test cases to cover all paths:
  - ???



# Combining ifs

```
if carDoors = 4:  
    if driverAge > 25:  
        premium = 650.0  
        status = "low risk"
```

```
if carDoors = 4 and driverAge > 25:  
    premium = 650.0  
    status = "low risk"
```

`##` what would `else` mean here?

# Combining ifs

```
if day == 1:           // Sun
    print("Have a good weekend")
elif day == 7:         // Sat
    print("Have a good weekend")
```

```
if day == 1 || day == 7: // Sat or Sun
    print("Have a good weekend")
```