

Getting Started With Python Programming: Part II

- Getting information from the user (input)
- How information is stored, converting between different types
- Formatting text output

Python Print(): Compensating For An Annoyance

- Recall: print() automatically adds a blank line ("new line") to the end of text

```
print("hi")
print("hi")
```

- You can override the addition of newline by adding the following as the last argument in the call to print:

- **Format:**

```
end=<value to add to the end>
```

- **Name of the full example:** `suppressNewLine`

```
print("hi", end="")      hihi
print("hi")
```

```
print("hi", end="<JT smart>") hi<JT smart>hi
```

```
print("hi")              hi<JT smart>
```

James Tam

Input

- The computer program getting *string information* from the user.
- Strings cannot be used for calculations (information for getting numeric input will be provided shortly).

•Format:

`<variable name> = input()`

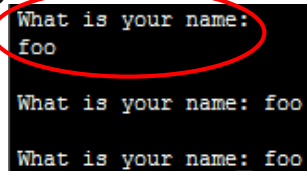
OR

`<variable name> = input("<Prompting message>")`

Avoid alignment issues such as this

•Name of the full example: 9input.py

```
print("What is your name: ")
name = input()
OR
name = input("What is your name: ")
OR
print("What is your name: ", end="")
name = input()
```



```
What is your name:
foo
What is your name: foo
What is your name: foo
```

James Tam

Variables: Storing Information (If There Is Time)

- On the computer all information is stored in binary (2 states)
 - Example: RAM/memory stores information in a series of on-off combinations
 - A single on/off combination is referred to as a 'bit'

Bit



Byte

•8 bits



James Tam

Variables: Storing Information (If There Is Time)

- Information must be converted into binary to be stored on a computer.

User enters $\longrightarrow$ Can be stored as
13



slide 5

James Tam

Interpreting Binary Patterns

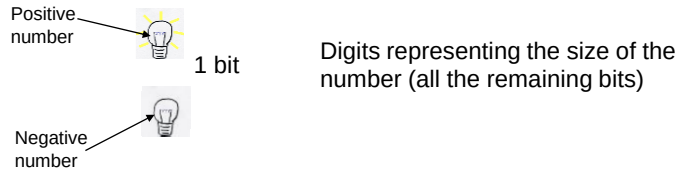
- What meaning is ascribed to a particular pattern will depend upon the context e.g. 32 binary digits:
 - Color information for a single pixel (24 bits for the primary colors, 8 bits for the transparency level/alpha blending).
 - OR
 - The 32 digits could be used to store 4 text characters.
 - If you find it hard to comprehend how a bit pattern can be interpreted in different ways given the context consider how the “same words” (i.e. the same set of alphabetic characters) can have different meanings because those letters are ascribing different meanings in different languages:
 - (One example, view at your own discretion it’s not mandatory reading: last viewed August 2023):
 - <https://www.rd.com/list/english-words-meanings-other-languages/>

James Tam

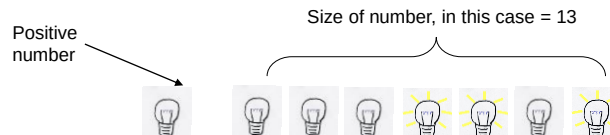
Storing Integer Information (If There Is Time)

- 1 bit is used to represent the sign, the rest is used to store the size of the number
 - Sign bit: 1/on = negative, 0/off = positive

- **Format:**



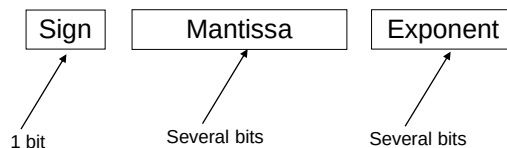
- **Previous example**



slide 7

James Tam

Storing Real Numbers In The Form Of Floating Point (If There Is Time)



- Mantissa: digits of the number being stored
- Exponent: the direction (negative = left, positive=right) and the number of places the decimal point must move ('float') when storing the real number as a floating point value.
- Examples with 5 digits used to represent the mantissa:
 - e.g. One: 123.45 is represented as $12345 * 10^{-2}$
 - e.g. Two: 0.12 is represented as $12000 * 10^{-5}$
 - e.g. Three: 123456 is represented as $12345 * 10^1$
- Remember: Using floating point numbers may result in a loss of accuracy (the float is an approximation of the real value to be stored).

James Tam

Storing Character Information (If There Is Time)

- Typically characters are encoded using ASCII
- Each character is mapped to a numeric value
 - E.g., 'A' = 65, 'B' = 66, 'a' = 97, '2' = 50
- These numeric values are stored in the computer using binary

Character	ASCII numeric code	Binary code
'A'	65	01000001
'B'	66	01000010
'a'	97	01100001
'2'	50	00110010

James Tam

Storing Information: **Bottom Line (You Need Know)**

- Why it important to know that different types of information is stored differently?
 - One motivation: sometimes students don't why it's significant that "123" is not the same as the number 123.
 - Certain operations only apply to certain types of information and can produce errors or unexpected results when applied to other types of information.
- **Example**

```
num = input("Enter a number")
numHalved = num / 2
```

James Tam

Converting Between Different Types Of Information

- Example motivation: you may want numerical information to be stored as a string (for built in string functions e.g., check if a string consists only of numbers) but also you want to perform calculations).
- Some of the conversion mechanisms (functions) available in Python:

Format:

```
int(<value to convert>)
float(<value to convert>)
str(<value to convert>)
```

Digits right of decimal are removed (truncation - no rounding)

Value to convert

(↓)

Conversion function



Converted result

Examples:

Name of the full example: 10convert.py

```
var1 = 10.9
```

```
var2 = int(var1)
```

```
print(var1, var2)
```

10.9 10

James Tam

Overloaded Operators

- The same symbol can have different results depending upon the context.
- Example: the 'plus' operator +
 - Previously this symbol represented mathematical **addition** because the values left and right of the symbol (operands) were numeric e.g.,
num1 = 2 + 2
 - If the operands are strings then the symbol represents the string operation **concatenation** e.g.,
str1 = "2" + "2"

James Tam

Overloaded Operators (2)

- **Name of the full example:** 11overloadedOperator.py

```
var1 = "100"  
var2 = "-10.5"  
# Concatentation operation (combines two strings).  
print(var1 + var2)  
  
# Addition operation is performed.  
print(int(var1) + float (var2))  
  
#Error cannot perform a concatenation on a number  
str2 = "2" + 2
```

James Tam

Converting Types: Extra Practice For Students

- Determine the output of the following program:

```
print(12+33)  
print("12"+"33")  
x = 12  
y = 21  
print(x+y)  
print(str(x)+str(y))
```

James Tam

Converting Between Different Types Of Information: Getting Numeric Input

- The 'input()' function only returns a string so the value returned must be converted to the appropriate type as needed.

– Name of the full example: 12convert4Input.py

No conversion performed: problem!

```
HUMAN_CAT_AGE_RATIO = 7
```

```
age = input("What is your age in years: ")
```

```
catAge = age * HUMAN_CAT_AGE_RATIO
```

```
print ("Age in cat years: ", catAge)
```

- 'Age' refers to a string not a number.
- The '*' is not mathematical multiplication

```
What is your age in years: 12
Age in cat years: 12121212121212
```

James Tam

Converting Between Different Types Of Information: Getting Numeric Input (2)

Input converted: Problem solved!

```
HUMAN_CAT_AGE_RATIO = 7
```

```
ageString = input("What is your age in years: ")
```

```
ageNum = int(ageString)
```

```
catAge = ageNum * HUMAN_CAT_AGE_RATIO
```

```
print("Age in cat years: ", catAge)
```

- 'Age' converted to an integer.
- The '*' now multiplies a numeric value.

```
print("Alternative: combines 2 steps into 1")
```

```
age = int(input("What is your age in years: "))
```

```
catAge = age * HUMAN_CAT_AGE_RATIO
```

```
print("Age in cat years: ", catAge)
```

```
What is your age in years: 12
Age in cat years: 84
```

James Tam

Section Summary: Input, Representations

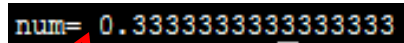
- How to get user input in Python
- How do the different types of variables store/represent information (optional/extra for now)
- How/why to convert between different types

James Tam

By Default Output Is Unformatted

- Example:

```
num = 1/3  
print("num=", num)
```



```
num= 0.3333333333333333
```

Sometimes you
get extra spaces
(or blank lines)

The number of places of
precision is determined by
the language not the
programmer

- There may be other issues e.g., you want to display output in columns of fixed width, or right/left aligned output
- There may be times that specific precision is needed in the displaying of floating point values

James Tam

Formatting Output

- Output can be formatted in Python through the use of **format specifiers** and **escape codes**

James Tam

Format Specifiers (If There Is Time)

- Format:**

```
print ("%<placeholder for type of info to display/code>"
        %<source of the info to display>)
```

Doesn't literally display this: It's a placeholder (for information to be displayed)

- Example (starting with simple cases):**

- Name of the full example: 13formatSpecifiersAsPlaceholders

```
num = 123
st = "cpsc 231"
print("num=%d" %num)
print("course: %s" %st)
num = 12.5
print("%f %d" %(num,num))
```

```
num=123
course: cpsc 231
12.500000 12
```

James Tam

Types Of Information That Can Be Formatted Via Format Specifiers (Placeholders)

Specifier	Type of Information to display
%s	String
%d	Integer
%f	Floating point

James Tam

Format Specifiers: Precision & Field Width

- **Precision:**

- The number of digits to the right of the decimal point.
 - E.g. 3.14 has 2 places of precision
- Alternate ways of specifying this term as: number of places of precision, number of fractional digits

- **Field width:**

- Think of it as “the width of a column” (the column created for each format specifier/placeholder).
 - E.g. 1: Four column width %4s
 - E.g. 2: Ten column width %10d
- When the column is too narrow to display the data then the column width is automatically expanded.
- When the column is wider than the width of the data then extra spaces will be added before or after the data.
 - Space before the first “ab” and a space after the second “ab” 
 - Space after the first “ab” and a space before the second “ab” 

James Tam

One Application Of Format Specifiers

- It can be used to align columns of text.
- Example (movie credits, tabular or financial information)



James Tam

Section Summary: Formatting Output

- How to use format specifiers (field width, precision) to format output

James Tam

Escape Codes/Characters

- The back-slash character enclosed within quotes won't be displayed but instead indicates that a formatting (escape) code will follow the slash:

Escape sequence	Description
\a	Alarm: Causes the program to beep.
\n	Newline: Moves the cursor to beginning of the next line.
\t	Tab: Moves the cursor forward one tab stop.
\'	Single quote: Prints a single quote.
\"	Double quote: Prints a double quote.
\\	Backslash: Prints one backslash.

James Tam

Escape Codes (2)

- Program name:** 15escapeCodes.py

```
print ("\a*Beep!*")
```

```
*Beep!* (may not work through text-on
```

```
print ("hi\nthere")
```

```
hi
there
```

```
print ("he\ly \\"you\\")
```

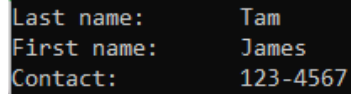
```
he\y "you"
```

James Tam

Escape Codes: Application

- It can be used to nicely format text output (alignment output, provide separators within and between lines)
- **Program example:** 16escapeCodes4Alignment.py

```
firstName = "James"
lastName = "Tam"
mobile = "123-4567"
print("Last name:\t", lastName)
print("First name:\t", firstName)
print("Contact:\t", mobile)
```



```
Last name:      Tam
First name:     James
Contact:        123-4567
```

James Tam

Section Summary: Escape Codes

- How to use escape codes to format output

James Tam

Extra Practice

- Traces:
 - Modify the examples (output using format specifiers and escape codes) so that they are still valid Python statements.
 - Alternatively you can try finding some simple ones online or from a textbook.
 - Hand trace the code (execute on paper) without running the program.
 - Then run the program and compare the actual vs. expected result.
- Program writing:
 - Write a program the will right-align text into 3 columns of data.
 - Write a program the will left-align text into 3 columns of data.

James Tam

After This Section You Should Now Know

- How to get text information from the user
- How to use 3 functions converting between different types of variables
- How to format output through:
 - The use of format specifiers (if there is time)
 - Escape codes

James Tam