

CSCI 127: Introduction to Computer Science



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Review of Lecture 1: turtle graphics

- Imagine a turtle has a pen; when it moves forward some distance, a line is drawn on the screen.
- The turtle can also turn left some amount of degrees.

```
1 import turtle
2
3 t = turtle.Turtle()
4
5 #draw side one
6 t.forward(100)
7 t.left(120)
8
9 #draw side two
10 t.forward(100)
11 t.left(120)
12
13 #draw side three
14 t.forward(100)
15 t.left(120)
```

Review of Lecture 1: for-loops

- The previous program used the turtle module to draw a triangle
- Rewrite the program using a for-loop

```
1 import turtle
2
3 t = turtle.Turtle()
4
5 for i in range(3):
6     t.forward(100)
7     t.left(120)
```

For more commands, read [turtle documentation](#)

Draw a polygon with $n \geq 3$ sides

Pseudocode describes the general algorithm our program will follow; it is language-agnostic and can be translated into any programming language.

Import the turtle library

Instantiate a turtle object called `t`

Initialize `n` to be an integer ≥ 3

Repeat the following `n` times:

- (1) `t` moves forward a fixed distance
- (2) `t` turns left $360 / n$ degrees

Group Work: predict what will be printed

```
1
2 for j in [0,1,2,3,4,5]:
3     print(j)
4 for count in range(6):
5     print(count)
6 for color in ["red", "green", "blue"]:
7     print(color)
```

Variables



- A **variable** is a reserved memory location for storing a value.
- Different kinds, or **types**, of values need different amounts of space:
 - ▶ **int**: integer or whole numbers
 - ▶ **float**: floating point or real numbers
 - ▶ **string**: sequence of characters
 - ▶ **list**: a sequence of items
e.g. [3, 1, 4, 5, 9] or ["violet", "purple", "indigo"]
 - ▶ **class variables**: for complex objects, like turtles.
- In Python (unlike other languages) you don't need to specify the type; it is deduced by its value.

Variable Names



- There's some rules about valid names for variables.
- Can use the underscore ('_'), upper and lower case letters.
- Can also use numbers, just can't start a name with a number.
- Can't use symbols (like '+' or '*') since used for arithmetic.
- Can't use some words that Python has reserved for itself (e.g. `for`).
(List of reserved words in *Think CS*, §2.5.)

Standardized Code for Characters

American Standard Code for Information Interchange (ASCII), 1960.

ASCII TABLE

| Decimal | Hex | Char | Decimal | Hex | Char | Decimal | Hex | Char | Decimal | Hex | Char |
|---------|-----|------------------------|---------|-----|---------|---------|-----|------|---------|-----|-------|
| 0 | 0 | [NULL] | 32 | 20 | [SPACE] | 64 | 40 | @ | 96 | 60 | ` |
| 1 | 1 | [START OF HEADING] | 33 | 21 | ! | 65 | 41 | A | 97 | 61 | a |
| 2 | 2 | [START OF TEXT] | 34 | 22 | " | 66 | 42 | B | 98 | 62 | b |
| 3 | 3 | [END OF TEXT] | 35 | 23 | # | 67 | 43 | C | 99 | 63 | c |
| 4 | 4 | [END OF TRANSMISSION] | 36 | 24 | \$ | 68 | 44 | D | 100 | 64 | d |
| 5 | 5 | [ENQUIRY] | 37 | 25 | % | 69 | 45 | E | 101 | 65 | e |
| 6 | 6 | [ACKNOWLEDGE] | 38 | 26 | & | 70 | 46 | F | 102 | 66 | f |
| 7 | 7 | [BELL] | 39 | 27 | ' | 71 | 47 | G | 103 | 67 | g |
| 8 | 8 | [BACKSPACE] | 40 | 28 | (| 72 | 48 | H | 104 | 68 | h |
| 9 | 9 | [HORIZONTAL TAB] | 41 | 29 |) | 73 | 49 | I | 105 | 69 | i |
| 10 | A | [LINE FEED] | 42 | 2A | * | 74 | 4A | J | 106 | 6A | j |
| 11 | B | [VERTICAL TAB] | 43 | 2B | + | 75 | 4B | K | 107 | 6B | k |
| 12 | C | [FORM FEED] | 44 | 2C | , | 76 | 4C | L | 108 | 6C | l |
| 13 | D | [CARRIAGE RETURN] | 45 | 2D | - | 77 | 4D | M | 109 | 6D | m |
| 14 | E | [SHIFT OUT] | 46 | 2E | . | 78 | 4E | N | 110 | 6E | n |
| 15 | F | [SHIFT IN] | 47 | 2F | / | 79 | 4F | O | 111 | 6F | o |
| 16 | 10 | [DATA LINK ESCAPE] | 48 | 30 | 0 | 80 | 50 | P | 112 | 70 | p |
| 17 | 11 | [DEVICE CONTROL 1] | 49 | 31 | 1 | 81 | 51 | Q | 113 | 71 | q |
| 18 | 12 | [DEVICE CONTROL 2] | 50 | 32 | 2 | 82 | 52 | R | 114 | 72 | r |
| 19 | 13 | [DEVICE CONTROL 3] | 51 | 33 | 3 | 83 | 53 | S | 115 | 73 | s |
| 20 | 14 | [DEVICE CONTROL 4] | 52 | 34 | 4 | 84 | 54 | T | 116 | 74 | t |
| 21 | 15 | [NEGATIVE ACKNOWLEDGE] | 53 | 35 | 5 | 85 | 55 | U | 117 | 75 | u |
| 22 | 16 | [SYNCHRONOUS IDLE] | 54 | 36 | 6 | 86 | 56 | V | 118 | 76 | v |
| 23 | 17 | [ENG OF TRANS. BLOCK] | 55 | 37 | 7 | 87 | 57 | W | 119 | 77 | w |
| 24 | 18 | [CANCEL] | 56 | 38 | 8 | 88 | 58 | X | 120 | 78 | x |
| 25 | 19 | [END OF MEDIUM] | 57 | 39 | 9 | 89 | 59 | Y | 121 | 79 | y |
| 26 | 1A | [SUBSTITUTE] | 58 | 3A | : | 90 | 5A | Z | 122 | 7A | z |
| 27 | 1B | [ESCAPE] | 59 | 3B | ; | 91 | 5B | [| 123 | 7B | { |
| 28 | 1C | [FILE SEPARATOR] | 60 | 3C | < | 92 | 5C | \ | 124 | 7C | |
| 29 | 1D | [GROUP SEPARATOR] | 61 | 3D | = | 93 | 5D |] | 125 | 7D | } |
| 30 | 1E | [RECORD SEPARATOR] | 62 | 3E | > | 94 | 5E | ^ | 126 | 7E | ~ |
| 31 | 1F | [UNIT SEPARATOR] | 63 | 3F | ? | 95 | 5F | _ | 127 | 7F | [DEL] |

(wiki)

ord() and chr()

(There is a link to the ASCII table on the course webpage, under "Useful Links".)

ASCII TABLE

| Decimal | Hex | Char | Decimal | Hex | Char | Decimal | Hex | Char | Decimal | Hex | Char |
|---------|-----|-------|---------|-----|------|---------|-----|------|---------|-----|------|
| 0 | 00 | | 1 | 01 | | 2 | 02 | | 3 | 03 | |
| 4 | 04 | | 5 | 05 | | 6 | 06 | | 7 | 07 | |
| 8 | 08 | | 9 | 09 | | 10 | 0A | | 11 | 0B | |
| 12 | 0C | | 13 | 0D | | 14 | 0E | | 15 | 0F | |
| 16 | 10 | | 17 | 11 | | 18 | 12 | | 19 | 13 | |
| 20 | 14 | | 21 | 15 | | 22 | 16 | | 23 | 17 | |
| 24 | 18 | | 25 | 19 | | 26 | 1A | A | 27 | 1B | B |
| 28 | 1C | a | 29 | 1D | b | 30 | 1E | c | 31 | 1F | d |
| 32 | 20 | space | 33 | 21 | ! | 34 | 22 | " | 35 | 23 | # |
| 36 | 24 | \$ | 37 | 25 | % | 38 | 26 | & | 39 | 27 | ' |
| 40 | 28 | (| 41 | 29 |) | 42 | 2A | * | 43 | 2B | + |
| 44 | 2C | , | 45 | 2D | - | 46 | 2E | . | 47 | 2F | : |
| 48 | 30 | 0 | 49 | 31 | 1 | 50 | 32 | 2 | 51 | 33 | 3 |
| 52 | 34 | 4 | 53 | 35 | 5 | 54 | 36 | 6 | 55 | 37 | 7 |
| 56 | 38 | 8 | 57 | 39 | 9 | 58 | 3A | : | 59 | 3B | ; |
| 60 | 3C | < | 61 | 3D | = | 62 | 3E | > | 63 | 3F | ? |
| 64 | 40 | @ | 65 | 41 | A | 66 | 42 | B | 67 | 43 | C |
| 68 | 44 | D | 69 | 45 | E | 70 | 46 | F | 71 | 47 | |
| 72 | 48 | | 73 | 49 | | 74 | 4A | | 75 | 4B | |
| 76 | 4C | | 77 | 4D | | 78 | 4E | | 79 | 4F | |
| 80 | 50 | | 81 | 51 | | 82 | 52 | | 83 | 53 | |
| 84 | 54 | | 85 | 55 | | 86 | 56 | | 87 | 57 | |
| 88 | 58 | | 89 | 59 | | 90 | 5A | | 91 | 5B | |
| 92 | 5C | | 93 | 5D | | 94 | 5E | | 95 | 5F | |
| 96 | 60 | | 97 | 61 | | 98 | 62 | | 99 | 63 | |
| 100 | 64 | | 101 | 65 | | 102 | 66 | | 103 | 67 | |
| 104 | 68 | | 105 | 69 | | 106 | 6A | | 107 | 6B | |
| 108 | 6C | | 109 | 6D | | 110 | 6E | | 111 | 6F | |
| 112 | 70 | | 113 | 71 | | 114 | 72 | | 115 | 73 | |
| 116 | 74 | | 117 | 75 | | 118 | 76 | | 119 | 77 | |
| 120 | 78 | | 121 | 79 | | 122 | 7A | | 123 | 7B | |
| 124 | 7C | | 125 | 7D | | 126 | 7E | | 127 | 7F | |
| 128 | 80 | | 129 | 81 | | 130 | 82 | | 131 | 83 | |
| 132 | 84 | | 133 | 85 | | 134 | 86 | | 135 | 87 | |
| 136 | 88 | | 137 | 89 | | 138 | 8A | | 139 | 8B | |
| 140 | 8C | | 141 | 8D | | 142 | 8E | | 143 | 8F | |
| 144 | 90 | | 145 | 91 | | 146 | 92 | | 147 | 93 | |
| 148 | 94 | | 149 | 95 | | 150 | 96 | | 151 | 97 | |
| 152 | 98 | | 153 | 99 | | 154 | 9A | | 155 | 9B | |
| 156 | 9C | | 157 | 9D | | 158 | 9E | | 159 | 9F | |
| 160 | A0 | | 161 | A1 | | 162 | A2 | | 163 | A3 | |
| 164 | A4 | | 165 | A5 | | 166 | A6 | | 167 | A7 | |
| 168 | A8 | | 169 | A9 | | 170 | AA | | 171 | AB | |
| 172 | AC | | 173 | AD | | 174 | AE | | 175 | AF | |
| 176 | B0 | | 177 | B1 | | 178 | B2 | | 179 | B3 | |
| 180 | B4 | | 181 | B5 | | 182 | B6 | | 183 | B7 | |
| 184 | B8 | | 185 | B9 | | 186 | BA | | 187 | BB | |
| 188 | BC | | 189 | BD | | 190 | BE | | 191 | BF | |
| 192 | C0 | | 193 | C1 | | 194 | C2 | | 195 | C3 | |
| 196 | C4 | | 197 | C5 | | 198 | C6 | | 199 | C7 | |
| 200 | C8 | | 201 | C9 | | 202 | CA | | 203 | CB | |
| 204 | CC | | 205 | CD | | 206 | CE | | 207 | CF | |
| 208 | D0 | | 209 | D1 | | 210 | D2 | | 211 | D3 | |
| 212 | D4 | | 213 | D5 | | 214 | D6 | | 215 | D7 | |
| 216 | D8 | | 217 | D9 | | 218 | DA | | 219 | DB | |
| 220 | DC | | 221 | DD | | 222 | DE | | 223 | DF | |
| 224 | E0 | | 225 | E1 | | 226 | E2 | | 227 | E3 | |
| 228 | E4 | | 229 | E5 | | 230 | E6 | | 231 | E7 | |
| 232 | E8 | | 233 | E9 | | 234 | EA | | 235 | EB | |
| 236 | EC | | 237 | ED | | 238 | EE | | 239 | EF | |
| 240 | F0 | | 241 | F1 | | 242 | F2 | | 243 | F3 | |
| 244 | F4 | | 245 | F5 | | 246 | F6 | | 247 | F7 | |
| 248 | F8 | | 249 | F9 | | 250 | FA | | 251 | FB | |
| 252 | FC | | 253 | FD | | 254 | FE | | 255 | FF | |

- `ord()`:
input type: character
output type: integer
- `chr()`:
input type: integer
output type: character
- What is `chr(33)`?
- What is `ord("$")`?

The plus (+) operator for numbers and strings



- $x = 3 + 5$ stores the number 8 in memory location x .
- $x = x + 1$ increases x by 1.
- $s = \text{"hi"} + \text{"Mom"}$ stores "hiMom" in memory locations s .
- $s = s + \text{"A"}$ adds the letter "A" to the end of the strings s .