15-110 Quiz2 Notes Sheet

Booleans, Conditionals, & Errors

Logical operators: `and`, `or`, `not`

New math operators: `%` (mod), `//` (div)

Short circuit evaluation: Python only evaluates the second half of a logical operation if it needs to

Conditional statement: control structure that allows you to make choices in a program.

```
if booleanExpr:
    ifBody
elif booleanExpr:
    elifBody
else:
    elseBody
```

Syntax Error: an error that occurs when Python cannot tokenize or structure code. Examples: `SyntaxError`, `IndentationError`, Incomplete Error

Runtime Error: an error that occurs when Python encounters a problem while running code. Examples: `NameError`, `TypeError`, `ZeroDivisionError`

Logical Error: an error that occurs when code runs properly but does not produce the intended result. Often (but not always) caused by a failed test case with `AssertionError`

```
assert(funName(input) == output)
```

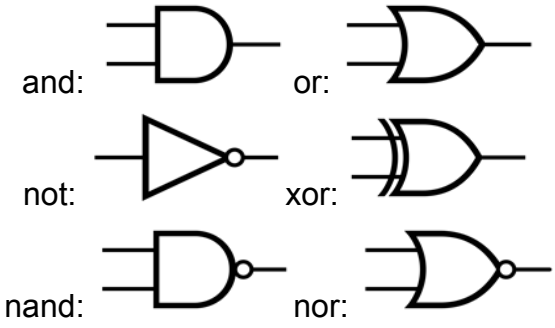
Circuits and Gates

Circuit: a hardware component that manipulates bits to compute an algorithmic result. Can also be simulated with an abstract version.

Gate: an abstract component of a circuit. Takes some number of bits as input and outputs a bit.

Gates: $\wedge$ (and), $\vee$ (or), $\neg$ (not), $\oplus$ (xor); also nand and nor (no special symbols)

Gates (in circuits):



Truth table: a table that lists all possible input bit combinations and the resulting output for a particular gate or circuit

Half-adder: a circuit that takes two one-digit binary numbers, adds them, and outputs two digits as the result

Full adder: a circuit that takes two one-digit binary numbers and a carried-in digit, adds all three, and outputs two digits as the result

N-bit adder: a circuit that takes two n-bit numbers, adds them together by chaining together n full adders, and outputs a n+1-digit result

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While Loops

While loop: a control structure that lets you repeat actions while a given Boolean expression is `True`

```
while booleanExpr:
    whileBody
```

Infinite loop: a while loop that never exits due to the state of the program

Loop control variable: a variable used to manipulate the number of times a loop iterates. Requires a start value, update action, and continuing condition.

`input(msg)` - prints `msg`, lets the user type a response, then returns the response as a string

For Loops

For loop: a control structure that lets you repeat actions a specific number of times

```
for var in range(rangeArgs):
    forBody
```

Range: a function that generates values for the loop control variable in a for loop. Can take 1-3 inputs.

```
range(end) # [0, end)
range(start, end) # [start, end)
range(start, end, step)
# step provides the increment
```

Looping over Strings

Index: access a specific value in a sequence based on its position. Positions start at `0` and end at `len(seq)-1`. Non-existent indexes result in `IndexError`.

```
strExpr[index]
```

Slice: access a subsequence of a larger sequence based on a given start, end (not inclusive), and step

```
strExpr[start:end:step] # slice
strExpr[start:end] # also slice
# default to 0:len(strExpr):1
```

Looping over strings: use range and indexing to access one character at a time.

```
for i in range(len(strExpr)):
    something with strExpr[i]
```

General Control Structures

Control flow chart: chart that designates how a program steps through commands. Uses branches for conditional checks and arrows leading back to previous commands for loops.

Nesting: a control structure can be included in the body of another control structure through use of indentation.

Nested loop: a loop with another loop in its body. The inner loop is fully executed for each iteration of the outer loop.