Data Structures (CS 1520) Lecture 1 Name:_____

1. **Python 3.x vs. 2.x Changes:**

- The `print` statement has been replaced with a `print()` function, with keyword arguments to replace most of the special syntax of the old print statement. New function syntax:

```
print(value,...,sep=' ',end='\n', file=sys.stdout)
```

a) Predict the expected output of each of the following.

Version 2.x	Version 3.x	Expected Output
`print 'cat',5,'dog'`	`print('cat',5,'dog')`	cat 5 dog \n
`print`	`print()`	\n

`print 'cat',5,`
`print 'horse'`
`print 'cow'`
	`print('cat',5,end='')`
	`print(' horse')`
	`print('cow')`
		cat 5 horse \n
		cow \n

Version 3.x	Expected Output
`print ('cat',5,'dog',sep='23',end='#')`	cat 23 5 23 dog#
`print ('cat',5,'dog',end='#',sep='23')`	cat 23 5 23 dog#
`print ('cat',5,'dog',sep='23','horse')`	error
`print ('cat',5,'dog',sep='>'*3)`	cat>>>5>>>dog\n

- The `range()` now behaves like `xrange()` of version 2.x. The `xrange()` function no longer exists in version 3.
- `raw_input()` was renamed to `input()`. That is, the new `input()` function reads a line from sys.stdin and returns it as a string with the trailing newline stripped. It raises `EOFError` if the input is terminated prematurely. To get the old behavior of `input()`, use `eval(input())`.
  Example, use a `for` loop to generate a sequence of values one at a time for each iteration of the loop:

```
n = eval(input("Enter # of iterations? "))
for count in range(n):
    print(count, end="  ")
print("\nDone")
```

```
Enter # of iterations? 6
0  1  2  3  4  5
Done
```

- Removed <> as an alternate "not equal" operator, so use != instead.
- There is only one built-in integral type, named `int`. It behaves like the old `long` type.
- An expression like `1/2` returns a float. Use `1//2` to get the truncating "integer division" behavior of version 2.
- Dictionary methods `dict.keys()`, `dict.items()` and `dict.values()` return interable "views" instead of lists. For example, this no longer works: `keyList = d.keys(); keyList.sort()`. Use `keyList = sorted(d)` instead.
  (Also, the dict.iterkeys(), dict.iteritems() and dict.itervalues() methods are no longer supported.)

2. Review of assignment statements. Predict the output of the following programs

```
a = 123
b = a
a += 1
print ('a is', a)
print ('b is', b)
print()

c = ['cat', 'dog']
d = c
c.append('cow')
print('c is', c)
print('d is', d)
```

a is 124\n
b is 123\n
\n
c is ['cat', 'dog', 'cow']
d is ['cat', 'dog', 'cow']

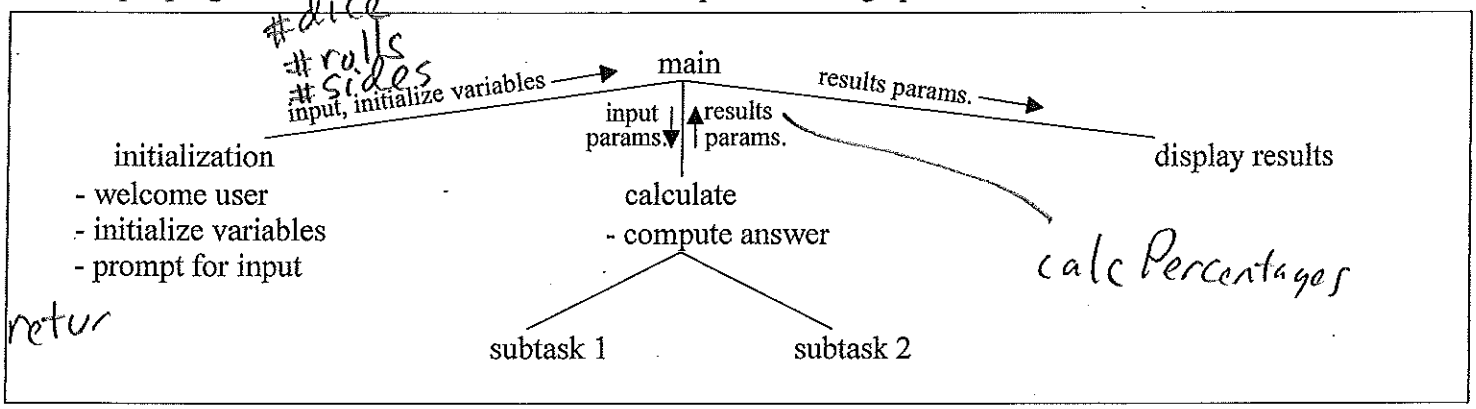
124
a → 123
b

```
c = 'cat'
d = c
c += 'fish'
print('c is', c)
print('d is', d)
```

c is catfish
d is cat

3. Design a program to roll two 6-sided dice 1,000 times to determine the percentage of each outcome (i.e., sum of both dice). Report the outcome(s) with the highest percentage.

Most simple programs have a similar functional-decomposition design pattern:



a) Customize the diagram for the dice problem by briefly describing what each function does and what parameters are passed.

import random

random.randint(1,6)

0 1 2 3 12 ← index is outcome

outcomeCounts: [0,0,0,0,0,0,0,...,0] ← counts

b) An alternative design methodology is to use object-oriented design. For the above dice problem, what objects would be useful and what methods (operations on the objects) should each perform?

Objects: Die with methods: roll, getRoll, getSides

TallySheet with methods: increment, clear,

```
import random

def main():
    numRolls, numSides, numDice = getInputs()
    outcomeCounts = rollDice(numRolls, numSides, numDice)
    outcomePercentages = calcPercentages(outcomeCounts, numRolls)


def getInputs():
    numRolls = input("Enter # of rolls: ")
    numSides = 
    numDice = 
    return numRolls, numSides, numDice

def rollDice(numRolls, numSides, numDice):
    outcomeCounts = [0]*(numSides*numDice+1)
    for
    .
    .
    .
    return outcomeCounts

main()
```