More Exam 1 Practice Problems

---

1. What is the value of x (True or False)?

```
X = 5%2 and 5 < 2 + 4
```

---

2. Which code snippet below correctly finds the number of digits of the sum of two integers? Either value may be positive, negative, or zero.

   Examples:

   - 12+6 = 18 → 2 digits
   - -12+2 = -10 → 2 digits (the negative sign does not count)
   - 0+3 = 3 → 1 digit

   The following code is executed before each answer's code below:

   ```
   Num1 = int(input('Enter first integer: ')
   Num2 = int(input('Enter second integer: ')
   numSum = num1 + num2
   ```

   a)
   ```
   myString = str(numSum)
   strLength = len(myString) - 1
   print('number of digits of ', numSum,'is ', strLength)
   ```

   b)
   ```
   count = 0
   temp = abs(numSum)
   while temp > 1:
      temp = temp / 10
      count = count + 1
   print('number of digits of ', numSum,'is ', count)
   ```

   c)
   ```
   if numSum < 0:
      myString = str(-numSum)
   else:
      myString = str(numSum)
   strLength = len(myString)
   print('number of digits of ', numSum,'is ', strLength)
   ```

   d) None of the above

---

3. Write a Python program that takes as inputs 5 integers. The program should check to see if any of the 5 are duplicates of another (i.e., check whether any of the integers were entered more than once). If, after all inputs are entered, a duplicate is found, the program should print "Duplicates", otherwise it should print "All Unique".

---

4. T/F "Debugging" means: finding where the program is failing, determining the error, and fixing it.

---

5. T/F Integers can be positive or negative or zero

---

6. T/F The code below will run without errors.

```
# Assume that the user enters 1.5
side = input('Please enter the side of a square: ')
a = side**2
print('The area of the square is: ', a)
```

7. What will the code output be?

```
a = 1
b = 2
c = 'a'
d = int(float('3.14'))
if a == 1 and d == 3.14:
    print('Green')
elif c == a or d > 3:
    print('Red')
else:
    print('Yellow')
```

8. What is the data type of variable x?

```
x = 5/5
```

9. Write a program that will ask a user to enter names and ages of people, stopping when an age of 0 is entered (and not processing that person). The program should collect this information, and then output the average age, the name of the oldest person, and the name of the youngest person. Assume no two people have the same age.

10. Given a list of words stored in the variable List_words, output the longest word and the length of the longest word (assume that there will be only 1 word of the longest length). Output may look like:

```
The longest word ‘champions’ has 9 characters.
```

11. Explain when one would use a while loop, and when one would use a for loop.

12. In your own words, explain what is meant by the Pyramid approach to program development.

13. The Maclaurin series expansion for $1/(1-x)$ on an interval from $-1 < x < 1$ is as follows:

$$\frac{1}{1-x} = \sum_{n=0}^{\infty} x^n = 1 + x + x^2 + x^3 + x^4 + \cdots + x^n$$

Write Python code which asks for input of a value of x on the interval $-1 < x < 1$, and which computes an approximation to $1/(1-x)$ using the using the series expansion summation. The summation should be continued until the term to be added to the summation is less than 10^{-6} in absolute value. Hint: Note that each term in the series is x raised to a power, including the 1 and x terms: $x^0=1$ and $x^1=x$

14. For the Python code given below, what would be printed to the screen? If the code would produce an error, write "Error". If there would be no output, write "None".

```
x = 10
y = 5
if x%2 == 0:
    if y>5:
        print("A")
    else:
        print("B")
        print("C")
else:
    if y<5:
        print("D")
    else:
        print("E")
        print("F")
print("G")
print("H")
```

15. For the Python code, what would the outputs be? Write them in the blanks spaces provided. Only fill in the blanks when there actually is output!

```
x = 2
y = "A"
while x<100:
        print(x, y)
        x *= x
        y += y
```

16. Write a Python program which uses loops that can output the following pattern.

```
1
22
333
4444
55555
666666
7777777
88888888
```

17. Given a list xdata of unknown length that contains x values, write the code to calculate a y-value for each x-value using the equation below. Store the calculated y values in a list called y_data. Do not use numpy arrays for this problem. Please use Python list functions, list methods, and list operators.

$$y = 4.12x^2 + 1.52x - 7.1$$

18. List 4 different data types that we have encountered so far in this course (excluding lists, arrays, tuples, complex variables) and then assign one example value of each type to the variables listed below

19. How does the % operator differ from the / operator in Python?

20. Sheldon Cooper's (of Big Bang Theory) favorite number is 73. One of his reasons is that 73 is a prime number and there are 21 prime numbers between 1 and 73. A prime number is a number greater than 1 that is not divisible by another number (the only even number that is a prime number is 2; all other prime numbers are odd). Write the Python code to calculate and print the prime numbers between 1 and 73 (but not including 73). Your program will also need to count the prime numbers to see if this is really the 21th prime number.

21. The series expansion for $\ln\left(\frac{1+x}{1-x}\right)$ with -1 < x < 1 is expressed as

$$\ln\left(\frac{1+x}{1-x}\right)=\sum_{n=1}^{\infty}\frac{2}{(2n-1)}x^{2n-1} \quad \text{or} \quad \ln\left(\frac{1+x}{1-x}\right)=2x+\frac{2}{3}x^3+\frac{2}{5}x^5+\frac{2}{7}x^7+\ldots$$

Write the Python code to input a value of x from the interval $-1 < x < 1$, verify that x is within this range (if not re-enter a value within the range), and then evaluate the series expansion summation for $\ln\left(\frac{1+x}{1-x}\right)$ for the value of x until the absolute value of a term in the summation is less than the TOL, which is 1.0E-06. For example, if x = 0.5, the first term is for n=1 is $\frac{2}{(2*1-1)}x^{2*1-1}$, or 2$x$. Since this term is > TOL, add the term to the summation variable and continue. This logic continues until one of the terms will be < TOL, and the summation stops and outputs the results. The natural log function in Python can be found in the math module with the format `math.log()`.

---

22. Without using a list, array, or tuple, write the Python code that will input a series of positive floating point numbers until a negative value is entered. The program should then output the maximum number, the minimum number and the average number for this series.

---

23. What is the output of the code shown here?

```
x = 3
y = 4
if x%2 == 0:
    if y>3:
        print("A")
    else:
        print("B")
        print("C")
else:
    if y<5:
        print("D")
    else:
        print("E")
        print("F")
print("G")
```

---

24. What is the output of the code shown here?

```
for i in range(12):
        if i%2!=1 and i%3==0:
                print(i)
```

---

25. What is the output of the code shown here?

```
x = 2
y = "A"
while x<100:
        print(x, y)
        x *= x
        y += y
print(x)
print(y)
```

---

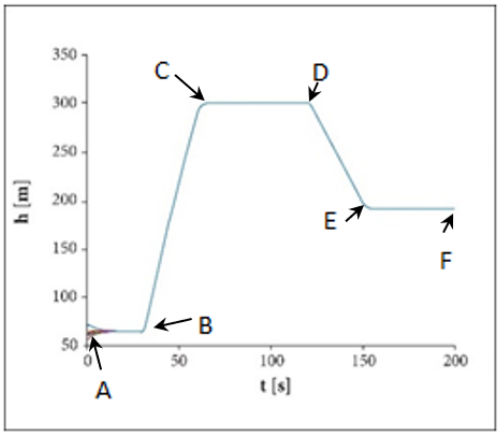
26. If we have a list called L of length > 10, using list slicing create a sub list called L_new of the 4th through the 7th elements of L. Now show how to modify the list L by removing the 2nd, 3rd, and 4th elements.

27. Given x=3 and y=5
Evaluate the following Boolean expressions:

(a) x != y – 2
(b) x >= 0 and not x < 10
(c) x < 0 and x < 10
(d) x >= 0 and x < 2
(e) x < 0 or y < 5
(f) not x > 0 or x < 10

---

28. The figure below depicts height above the ground (h) in meters versus time (t) in seconds. The data corresponds to a test flight involving several unmanned aerial vehicles (UAVs). We have a need for a Python code to predict the height above ground given time from the beginning of the flight. Your co-worker started the code as seen below, but you've been asked to finish it. Assume that height varies linearly with time in between the points shown. Your code should perform the following tasks:
    - Print a message to the screen describing what the code does.
    - Get input from the keyboard representing the time. (Don't forget the prompt.)
    - Check that the time entered is valid, and warn the user if invalid input.
    - Perform linear interpolation on the section of the curve that corresponds to the time value input to get the corresponding height value.
    - Print a nicely-formatted result to the screen that includes both the time entered and the corresponding height.

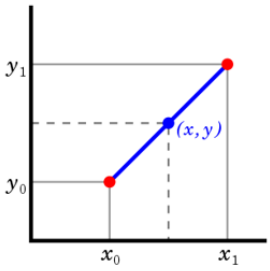



```
# Code to provide height of UAV given time from takeoff in seconds

# Define a height list and and corresponding time list for the point
# locations A, B, C, D, E, F in order
timeData=[0, 37, 58, 125, 150, 200]
heightData=[65, 65, 300, 300, 200, 200]

# Get user input from keyboard for a time value
# Find the corresponding line segment on the h vs. t curve
# Linearly interpolate to get the height value
# Output the input value for time and the corresponding height
```

Interpolation is the estimation of a value between two known points. Given the graph below, with known points (***x0, y0***) and (***x1,y1***), you would use these points to calculate a value of ***y*** for a given ***x*** value.



Additional Practice Problems:

Write a program that takes in an arbitrary amount of masses and corresponding volumes from a user and calculates the density for each individual pair. The output should be a list of densities. You should consider input errors and how to account for any problem a user might provide. For your use: Density = Mass / Volume

---

Write a program to solve a 4-digit combination lock. Program must set up a 'lock' with a 4-integer password (list of lists), and write a program to 'solve' the combination.

Write a program that computes the following, outputting all results with a descriptive sentence:

a. Calculates and outputs the area and the perimeter (circumference) for a circle with radius 2.59
b. Calculates and outputs the length of the side of a square that has the same area as that circle
c. Calculates and outputs the length of the side of a square that has the same perimeter as that circle.

Write a program that does the following:

a. asks for a user's name and score on three exams
b. calculates an average exam score
c. outputs a personalized message (i.e., using their name) giving the average of their test scores

---

Write a program that asks for a user's homework score, exam score, and whether they completed an outside project. Then have the program return the user's course letter grade.

- The basic grade is determined as 60% from exams, 40% from homework; grades range from 0 to 100.
- If the student completes an outside project, they receive an extra 5 points. The student must complete the outside project to receive an "A".
- Assume an "A" score is 90+, a "B" if in the 80s, a "C" if in the 70s, a "D" if in the 60s, and an "F" is less than 60.

Imagine you are writing a program to find and print the sum of two fractions. Each fraction will be read in from the user as an integer numerator and an integer denominator.

a. Write a set of variables you expect to use in your program. If it is not obvious from the name of the variable, note what the variable will store.
b. Write a brief set of steps you would follow in your program.
c. Write an appropriate set of test cases that you would use to test your program, to ensure it is working reasonably.

Write a program that asks a user for an integer value, and computes the double factorial of that number. The program should repeat until the user enters a non-positive number other than -1.

Mathematically, a double factorial is calculated as follows:

If n is even, then: n!! = n*(n-2)*(n-4)*(n-6)*...*(4)*(2)

If n is odd, then: n!! = n*(n-2)*(n-4)*(n-6)*...*(3)*(1)

By convention, if n = 0 or n = -1, then n!! = 1.

Examples:

7!! = 1*3*5*7 = 105.

8!! = 2*4*6*8 = 384.

Write a Python program to estimate the value of e according to the infinite series below:

$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \frac{1}{1} + \frac{1}{1} + \frac{1}{1 \cdot 2} + \frac{1}{1 \cdot 2 \cdot 3} + \ ...$$

Have your program loop through values of n until the value of the term to be added is less than a tolerance of 10-6. Remember to print your final answer. Do not use sympy, numpy, or the factorial() function.
Note: $0! = 1! = 1$

Write a Python program to take as input 5 birthdays from 5 users (1 each) and output them in chronological order. Dates should be entered with the month and day (not year) in the format “June 6” as a single input per user. You may format the output however you like (including using numbers for the month instead of words). This is a good problem to practice using dictionaries.

Write a Python program to play a simplified version of the game hangman. Have User 1 input a secret word with a minimum length of 6. Then, take as input from User 2 one letter at a time until they guess a letter not contained in the secret word. At the end of the program, print out the number of guesses and the secret word.

Example:

- User 1 enters the secret word “programming”.
- User 2 guesses the letter “n”
- User 2 guesses the letter “a”
- User 2 guesses the letter “e”
- The program outputs the number of guesses (3) and the secret word (programming)

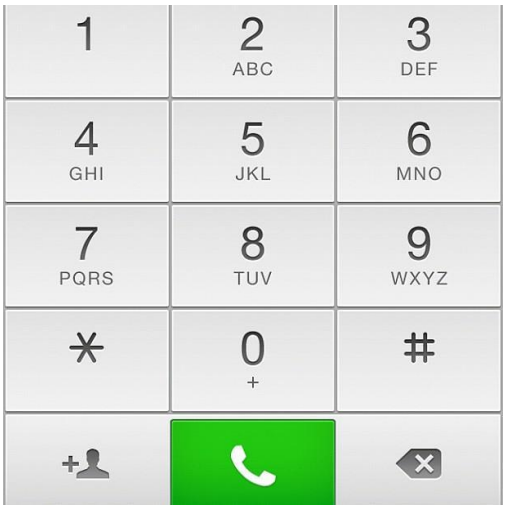
Write a Python program to generate the following output exactly as shown using a loop.

```
a
bb
ccc
dddd
eeeee
```

Write a Python program that will repeatedly ask a user to input a person's age. The program should continue to ask for input until a negative number is entered, indicating that the user is done inputting data. The program should determine the total number of people and the minimum and maximum ages entered. The results should be printed to the screen using the format shown below. Include the header and align the columns.

```
Number of people  Minimum age  Maximum age
32                17           24
```

A schematic for converting phone letters to digits mapping is shown in the image below. Write a Python program that prompts the user to enter a 10-character phone number in this format XXX-XXXXXXX. Your program should replace the last seven alphabetic characters by their equivalent digits and display the entered phone number in this format XXX-XXX-XXXX. For example, if the user enters `800-GOFEDEX`, your program output would be '`800-GOFEDEX` is equivalent to `800-463-3339`'. You may assume that the last seven characters are alphabetic characters from A – Z.



Short answer problems:

1. Briefly explain when it is a good idea to use an `if-elif-else` statement instead of multiple `if` statements.

2. Name 3 reasons for including comments when programming.

3. Briefly explain why it is bad practice to use the "arch" method of program development.

4. What are the differences between lists and dictionaries?

5. What are the similarities between strings and lists?

6. Given the string below, write one line of code to convert it into a list of its words.

```
mystr = 'Aggie Engineers Rock And Are In High Demand By Industry'
```

For the following problems, write the output of the code. Don't forget `[]` `{}` and/or `,` as needed.

1.
```
a = 5
b = 'b'
c = True
print("The answer is...", end=' ')
if a != 10:
    print("A", end=' ')
elif b == 'b':
    print("B", end=' ')
else:
    print("C", end=' ')
z = c and bool(a)
print(z, end=' ')
d = a ** 3 + 25 % 3 - 12 // 5
print(d)
```

2.
```
n = 1
p = "A"
while n < 10:
    p += p
    n += 3
print(n, p)
```

3.
```
a = True
b = bool('False')
c = 5 > 8
d = a and b and c
e = not a or not (b and c)
print(d, e)
```

4.
```
mystrs = ['Good Bull', 'Whoop', 'Hullabaloo', 'Howdy', "Gig 'em",
'Aggies']
mynums = [3, 5, 4, 1, 2]
for num in mynums:
    print(mystrs[num], end=' ')
```

5.
```
mydict = {'Ann' : 18, 'Bob' : 20, 'Charlie' : 19}
if 'Joe' in mydict:
    print("Joe is here")
elif 'Ann' in mydict:
    print("Hi Ann")
else:
    print("Anyone?")
```

6.
```
mystr = 'The quick brown fox jumped over the lazy dog'
print(mystr[:3], end=' ')
if mystr[4] == 'q':
    if 'fox' in mystr:
        print('fox', end=' ')
    else:
        print('dog', end=' ')
    if mystr[-5] != 'z':
        print('jumped', end=' ')
    else:
        print('hopped', end=' ')
elif 'x' in mystr:
    if 'white' in mystr:
        print('white mouse', end=' ')
    else:
        print('brown cow', end=' ')
    if 'y' not in mystr:
        print('sat', end=' ')
    else:
        print('dropped', end=' ')
else:
    print(mystr[4:26], end=' ')
print('down')
```

7.
```
mylist = []
for i in range(5):
    mylist.append(i ** 2)
print(mylist[-3:])
```

8.
```
mystr = "Howdy! Welcome to Texas A&M Engineering!"
print(mystr[:5] + mystr[6] + mystr[18:] + '\b students!')
```