**Basic Python**

1. Write a Python program which accepts the user's first and last name and print them in reverse order with a space between them.   
  
2. Write a Python program which accepts a sequence of comma-separated numbers from user and generate a list and a tuple with those numbers.   
Sample data : 3, 5, 7, 23  
Output :   
List : ['3', ' 5', ' 7', ' 23']   
Tuple : ('3', ' 5', ' 7', ' 23')  
  
3. Write a Python program to display the first and last colors from the following list.   
color\_list = ["Red","Green","White" ,"Black"]  
  
4. Write a Python program to print the documents (syntax, description etc.) of Python built-in function(s).   
Sample function : abs()  
Expected Result :   
abs(number) -> number  
Return the absolute value of the argument.  
  
5. Write a Python program to print the calendar of a given month and year.  
Note : Use 'calendar' module.   
  
6. Write a Python program to calculate the number of days between two dates.  
Sample dates : (2014, 7, 2), (2014, 7, 11)  
Expected output : 9 days   
  
7. Write a Python program to check whether a specified value is contained in a group of values.   
Test Data :   
3 -> [1, 5, 8, 3] : True  
-1 -> [1, 5, 8, 3] : False

8. Write a Python program to create a histogram from a given list of integers.   
  
9. Write a Python program to concatenate all elements in a list into a string and return it.   
  
10. Write a Python program to print out a set containing all the colors from color\_list\_1 which are not present in color\_list\_2.   
Test Data :   
color\_list\_1 = set(["White", "Black", "Red"])   
color\_list\_2 = set(["Red", "Green"])  
Expected Output :   
{'Black', 'White'}  
  
11. Write a Python program to convert an integer to binary keep leading zeros.   
Sample data : 50  
Expected output : 00001100, 0000001100  
  
12. Write a Python program to determine if the python shell is executing in 32bit or 64bit mode on operating system.   
  
13. Write a Python function to find the maximum and minimum numbers from a sequence of numbers.   
Note: Do not use built-in functions.  
  
**Python Data Structure**

**Array**

1. Write a Python program to create an array of 5 integers and display the array items. Access individual element through indexes.   
  
 2. Write a Python program to reverse the order of the items in the array.   
  
 3. Write a Python program to get the number of occurrences of a specified element in an array.   
   
 4. Write a Python program to remove the first occurrence of a specified element from an array.

**Dictionary**

1. Write a Python script to sort (ascending and descending) a dictionary by value.   
  
 2. Write a Python script to add a key to a dictionary.   
  
 Sample Dictionary : {0: 10, 1: 20}  
 Expected Result : {0: 10, 1: 20, 2: 30}  
   
 3. Write a Python script to concatenate following dictionaries to create a new one.   
  
 Sample Dictionary :   
 dic1={1:10, 2:20}   
 dic2={3:30, 4:40}   
 dic3={5:50,6:60}  
 Expected Result : {1: 10, 2: 20, 3: 30, 4: 40, 5: 50, 6: 60}  
   
 4. Write a Python program to iterate over dictionaries using for loops.   
  
 5. Write a Python script to generate and print a dictionary that contains a number (between 1 and n) in the form (x, x\*x).   
 Sample Dictionary ( n = 5) :   
 Expected Output : {1: 1, 2: 4, 3: 9, 4: 16, 5: 25}

**Sets**

1. Write a Python program to create a set.

2. Write a Python program to iteration over sets.

3. Write a Python program to add member(s) in a set.   
  
 4. Write a Python program to remove item(s) from set   
  
 5. Write a Python program to remove an item from a set if it is present in the set.   
  
 6. Write a Python program to create an intersection of sets.   
  
 7. Write a Python program to create a union of sets.   
  
 8. Write a Python program to create set difference.   
  
 9. Write a Python program to create a symmetric difference.   
  
 10. Write a Python program to clear a set.   
  
**List**

1. Write a Python program to sum all the items in a list.   
   
 2. Write a Python program to multiplies all the items in a list.   
   
 3. Write a Python program to get the smallest number from a list.   
   
 4. Write a Python program to count the number of strings where the string length is 2 or more and the first and last character are the same from a given list of strings.   
 Sample List : ['abc', 'xyz', 'aba', '1221']  
 Expected Result : 2  
   
 5. Write a Python program to get a list, sorted in increasing order by the last element in each tuple from a given list of non-empty tuples.   
 Sample List : [(2, 5), (1, 2), (4, 4), (2, 3), (2, 1)]  
 Expected Result : [(2, 1), (1, 2), (2, 3), (4, 4), (2, 5)]  
   
 6. Write a Python program to remove duplicates from a list.   
   
 7. Write a Python program to clone or copy a list.   
   
 8. Write a Python program to find the list of words that are longer than n from a given list of words.   
   
 9. Write a Python function that takes two lists and returns True if they have at least one common member.   
   
 10. Write a Python program to print a specified list after removing the 0th, 4th and 5th elements.   
 Sample List : ['Red', 'Green', 'White', 'Black', 'Pink', 'Yellow']  
 Expected Output : ['Green', 'White', 'Black']  
   
**Tuple**

1. Write a Python program to create a tuple.

2. Write a Python program to create a tuple with different data types.

3. Write a Python program to unpack a tuple in several variables.   
  
 4. Write a Python program to create the colon of a tuple.   
  
 5. Write a Python program to find the repeated items of a tuple.   
  
 6. Write a Python program to check whether an element exists within a tuple.   
  
 7. Write a Python program to convert a list to a tuple.   
  
 8. Write a Python program to remove an item from a tuple.   
  
 9. Write a Python program to slice a tuple.   
  
 10. Write a Python program to reverse a tuple.

**Strings**

1. Write a Python program to calculate the length of a string.

2. Write a Python program to count the number of characters (character frequency) in a string.   
 Sample String : google.com  
 Expected Result : {'o': 3, 'g': 2, '.': 1, 'e': 1, 'l': 1, 'm': 1, 'c': 1}  
  
 3. Write a Python program to get a string from a given string where all occurrences of its first char have been changed to '$', except the first char itself.   
 Sample String : 'restart'  
 Expected Result : 'resta$t'  
  
 4. Write a Python program to add 'ing' at the end of a given string (length should be at least 3). If the given string already ends with 'ing' then add 'ly' instead. If the string length of the given string is less than 3, leave it unchanged.   
 Sample String : 'abc'  
 Expected Result : 'abcing'   
 Sample String : 'string'  
 Expected Result : 'stringly'  
  
 5. Write a Python function that takes a list of words and returns the length of the longest one.   
  
 6. Write a Python script that takes input from the user and displays that input back in upper and lower cases.   
  
 7. Write a Python program that accepts a comma separated sequence of words as input and prints the unique words in sorted form (alphanumerically).   
 Sample Words : red, white, black, red, green, black  
 Expected Result : black, green, red, white,red  
  
 8. Write a Python program to get the last part of a string before a specified character.   
 https://www.w3resource.com/python-exercises  
 https://www.w3resource.com/python  
  
 9. Write a Python program to display formatted text (width=50) as output.

10. Write a Python program to count occurrences of a substring in a string.

**Linear Algebra**  
 1. Write a python program to add below matrices

X = [[12,7,3],

[4 ,5,6],

[7 ,8,9]]

Y = [[5,8,1],

[6,7,3],

[4,5,9]]

2. Write a program to perform scalar multiplication of matrix and a number

X = [[12,7,3],

[4 ,5,6],

[7 ,8,9]]

Y = 9

3. Write a program to perform multiplication of given matrix and vector

X = [[ 5, 1 ,3], [ 1, 1 ,1], [ 1, 2 ,1]], Y = [1, 2, 3]

4. Write a program to multiply matrices in problem 1

5. Write a program to find inverse matrix of matrix X in problem 1 .

6. Write a program to find transpose matrix of matrix Y in problem 1

**Probability and Statistics**

1. Write a program to find the probability of drawing an ace from pack of cards
2. Write a program to find the probability of drawing an ace after drawing a king on the first draw
3. Write a program to find the probability of drawing an ace after drawing an ace on the first draw
4. You toss a fair coin three times to write a program to find the following:
   1. What is the probability of three heads, HHH?
   2. What is the probability that you observe exactly one heads?
   3. Given that you have observed at least one heads, what is the probability that you observe at least two heads?

5. In my town, it's rainy one third of the days. Given that it is rainy, there will be heavy traffic with probability 1212, and given that it is not rainy, there will be heavy traffic with probability 1414. If it's rainy and there is heavy traffic, I arrive late for work with probability 1212. On the other hand, the probability of being late is reduced to 1818 if it is not rainy and there is no heavy traffic. In other situations (rainy and no traffic, not rainy and traffic) the probability of being late is 0.250.25. You pick a random day.

Write a program to find following

1. What is the probability that it's not raining and there is heavy traffic and I am not late?
2. What is the probability that I am late?
3. Given that I arrived late at work, what is the probability that it rained that day?

6. Given the following statistics, write a program to find the probability that a woman has cancer if she has a positive mammogram result?

a. One percent of women over 50 have breast cancer.

b. Ninety percent of women who have breast cancer test positive on mammograms.

c. Eight percent of women will have false positives.

7. A bank teller serves customers standing in the queue one by one. Suppose that the service time XiXi for customer ii has mean EXi=2EXi=2 (minutes) and Var(Xi)=1Var(Xi)=1. We assume that the service times for different bank customers are independent. Let Y be the total time the bank teller spends serving 5050 customers. Write a program to find P(90<Y<110)

8. In a communication system each data packet consists of 1000 bits. Due to the noise, each bit may be received in error with probability 0.1. It is assumed bit errors occur independently. Find the probability that there are more than 120 errors in a certain data packet.

9. In a particular pain clinic, 10% of patients are prescribed narcotic pain killers. Overall, five percent of the clinic’s patients are addicted to narcotics (including pain killers and illegal substances). Out of all the people prescribed pain pills, 8% are addicts. If a patient is an addict, write a program to find the probability that they will be prescribed pain pills?

10. X is a normally normally distributed variable with mean μ = 30 and standard deviation σ = 4. Write a program to find

a. P(x < 40)

b. P(x > 21)

c. P(30 < x < 35)

11. A radar unit is used to measure speeds of cars on a motorway. The speeds are normally distributed with a mean of 90 km/hr and a standard deviation of 10 km/hr. Write a program to find the probability that a car picked at random is travelling at more than 100 km/hr?

12. Write a program to find the probability of getting a random number from the interval [2, 7]

13. The table below shows the height, x, in inches and the pulse rate, y, per minute,

for 9 people. Write a program to find the correlation coefficient and interpret your results.

x ⇒ 68 72 65 70 62 75 78 64 68

y ⇒ 90 85 88 100 105 98 70 65 72

14. The patients were tested thrice before the oncologist concluded that they had cancer. The general belief is that 1.48 out of a 1000 people have breast cancer in the US at that particular time when this test was conducted. The patients were tested over multiple tests. Three sets of tests were done and the patient was only diagnosed with cancer if she tested positive in all three of them.True positive rates – 93% True negative Rate – 99%

15. Let’s say that you are at work one day and have just finished lunch. You suddenly feel horrible and find yourself lying down and within a few minutes begin to panic. Wasn’t your friend at work recently sick with the flu? What if you have it? Will you have to cancel your big trip next week?

You have a headache and sore throat, and you know that people with the flu have the same symptoms roughly 90% of the time. In other words, 90% of people with the flu have the same symptoms you currently have. Does this mean you have the flu?

Wanting to gain a little more information you roll over, grab your phone and search Google. You find a reputable article that says that only 5% of the population will get the flu in a given year. Ok. So, the probability of having the flu, in general, is only 5%.

You then spot one more statistic that says 20% of the population in a given year will have a headache and sore throat at any given time. After reading this you throw your phone down and curl up in your seat. You’re completely overwhelmed and more confused than you were to start. Do you have the flu? What should you do?

16. A device for testing defects in a certain electrocatalyst (EC) is envisaged to be advertised by the catalyst producer, claiming that it is 97% reliable if the EC is defective, and 99% reliable when it is flawless. Independently from any testing device and based upon earlier experience, 4% of said EC may be expected to be defective upon delivery. In order to ascertain the true reliability of the device, Bayes’ rule is applied to basic event set A: the EC is defective; A : the EC is flawless; B: the EC is tested to be defective; B : the EC is tested to be flawless, equipped with the full set of conditional events of interest here with their probabilities:

17. You go to see the doctor about an ingrown toenail. The doctor selects you at random to have

a blood test for swine flu, which for the purposes of this exercise we will say is currently suspected

to affect 1 in 10,000 people in Australia. The test is 99% accurate, in the sense that the probability

of a false positive is 1%. The probability of a false negative is zero. You test positive. What is the

new probability that you have swine flu?

Now imagine that you went to a friend’s wedding in Mexico recently, and (for the purposes of this

exercise) it is known that 1 in 200 people who visited Mexico recently come back with swine flu.

Given the same test result as above, what should your revised estimate for the probability you

have the disease?

18. Imagine that, while in Mexico, you also took a side trip to Las Vegas, to pay homage to the

TV show CSI. Late one night in a bar you meet a guy who claims to know that in the casino at

the Tropicana there are two sorts of slot machines: one that pays out 10% of the time, and one

that pays out 20% of the time [note these numbers may not be very realistic]. The two types

of machines are coloured red and blue. The only problem is, the guy is so drunk he can’t quite

remember which colour corresponds to which kind of machine. Unfortunately, that night the guy

becomes the vic in the next CSI episode, so you are unable to ask him again when he’s sober.

Next day you go to the Tropicana to find out more. You find a red and a blue machine side by side.

You toss a coin to decide which machine to try first; based on this you then put the coin into the

red machine. It doesn’t pay out. How should you update your estimate of the probability that this

is the machine you’re interested in? What if it had paid out - what would be your new estimate

then?

19.In Orange County, 51% of the adults are males. (It doesn't take too much advanced mathematics to deduce that the other 49% are females.) One adult is randomly selected for a survey involving credit card usage. a. Find the prior probability that the selected person is a male. b. It is later learned that the selected survey subject was smoking a cigar. Also, 9.5% of males smoke cigars, whereas 1.7% of females smoke cigars (based on data from the Substance Abuse and Mental Health Services Administration). Use this additional information to find the probability that the selected subject is a male.

20. An aircraft emergency locator transmitter (ELT) is a device designed to transmit a signal

in the case of a crash. The Altigauge Manufacturing Company makes 80% of the ELTs,

the Bryant Company makes 15% of them, and the Chartair Company makes the other

5%. The ELTs made by Altigauge have a 4% rate of defects, the Bryant ELTs have a 6%

rate of defects, and the Chartair ELTs have a 9% rate of defects (which helps to explain

why Chartair has the lowest market share).

a. If an ELT is randomly selected from the general population of all ELTs, find the

probability that it was made by the Altigauge Manufacturing Company.

b. If a randomly selected ELT is then tested and is found to be defective, find the

probability that it was made by the Altigauge Manufacturing Company.

21. HIV The New York State Health Department reports a 10% rate of the HIV virus

for the “at-risk” population. Under certain conditions, a preliminary screening test

for the HIV virus is correct 95% of the time. (Subjects are not told that they are

HIV infected until additional tests verify the results.) If someone is randomly

selected from the at-risk population, what is the probability that they have the

HIV virus if it is known that they have tested positive in the initial screening?

22. In a TV Game show, a contestant selects one of three doors; behind one of the doors there is a prize, and behind the other two there are no prizes. After the contestant selects a door, the game-show host opens one of the remaining doors, and reveals that there is no prize behind it. The host then asks the contestant whether they want to SWITCH their choice to the other unopened door, or STICK to their original choice. Is it probabilistically advantageous for the contestant to SWITCH doors, or is the probability of winning the prize the same whether they STICK or SWITCH? (Assume that the host selects a door to open, from those available, with equal probability).

23. A diagnostic test has a probability 0.95 of giving a positive result when applied to a person suffering

from a certain disease, and a probability 0.10 of giving a (false) positive when applied to a non-sufferer. It is

estimated that 0.5 % of the population are sufferers. Suppose that the test is now administered to a person about

whom we have no relevant information relating to the disease (apart from the fact that he/she comes from this

population). Calculate the following probabilities:

(a) that the test result will be positive;

(b) that, given a positive result, the person is a sufferer;

(c) that, given a negative result, the person is a non-sufferer;

(d) that the person will be misclassified.

24. : Imagine that you have three urns that you cannot see into. Urn1 is 90% green balls and 10% red. Urn2 is 50% green and 50% blue. Urn3 is 20% green, 40% red, and 40% blue. You can’t tell which urn is which. You randomly select an urn and then randomly select a ball from it. The ball you drew is green. What is the probability that it came from urn1?

25. Ram plays a game of Russian roulette. He loads 2 bullets in the adjacent slots of a six slot revolver. He revolves the cylinder and then pulls the trigger. Luckily, it is an empty slot. Ram has an option either to pull the trigger again or to spin the cylinder first and then pull the trigger. What must Ram choose to maximize his chances of survival?

26.The average age of major league baseball players is 28.3 years and has a standard deviation

of 2.3 years. If we can assume that ages are Normally distributed, what is the probability

that the average age of 10 randomly selected Red Sox players is less than 27 years?

27. Suppose the age a student graduates from Salem State is Normally distributed. If the mean

age is 23.1 years and the standard deviation is 3.1 years, what is the probability that 6

randomly selected students had a mean age at graduation that was greater than 27?

28. While checking receipts at Reds, it was determined that the average amount spent on food

per table was $21.50 with a standard deviation of $2.22. If we can assume that the amount of

money spent was Normally distributed, what is the probability that the average of 8 checks

is between $20 and $23?

29. The amount of regular unleaded gasoline purchased every week at a gas station near UCLA follows the normal distribution

with mean 50000 gallons and standard deviation 10000 gallons. The starting supply of gasoline is 74000 gallons, and there is a

scheduled weekly delivery of 47000 gallons.

a. Find the probability that, after 11 weeks, the supply of gasoline will be below 20000 gallons.

b. How much should the weekly delivery be so that after 11 weeks the probability that the supply is below 20000 gallons

is only 0.5%?

30. Among all the computer chips produced by a certain factory, 6 percent are defective.  
A sample of 400 chips is selected for inspection.  
a) What is the probability that this sample contains between 20 and 25 defective chips (including  
20 and 25)?  
b) Suppose that each of 40 inspectors collects a sample of 400 chips. What is the probability  
that at least 8 inspectors will find between 20 and 25 defective chips in their samples?