

1) Python Program to Implement Pigeonhole Sort Algorithm

Program Code:

```
def pigeonhole_sort(a):

    # size of range of values in the list

    # (ie, number of pigeonholes we need)

    my_min = min(a)

    my_max = max(a)

    size = my_max - my_min + 1

    # our list of pigeonholes

    holes = [0] * size

    # Populate the pigeonholes.

    for x in a:

        assert type(x) is int, "integers only please"

        holes[x - my_min] += 1

    # Put the elements back into the array in order.

    i = 0

    for count in range(size):

        while holes[count] > 0:

            holes[count] -= 1

            a[i] = count + my_min

            i += 1

a = [8, 3, 2, 7, 4, 6, 8]

print("Sorted order is : ", end=" ")

pigeonhole_sort(a)

for i in range(0, len(a)):
```

```
print(a[i], end=" ")
```

Output:

Sorted order is : 2 3 4 6 7 8 8

2) Python Program to Implement Breath First Search(BFS)

Program code:

```
#BFS algorithm in Python
```

```
import collections
```

```
# BFS algorithm
```

```
def bfs(graph, root):
```

```
    visited, queue = set(), collections.deque([root])
```

```
    visited.add(root)
```

```
    while queue:
```

```
        # Dequeue a vertex from queue
```

```
        vertex=queue.popleft()
```

```
        print(str(vertex) + " ",end=" ")
```

```
        # If not visited, mark it as visited, and
```

```
        # enqueue it
```

```
        for neighbour in graph[vertex]:
```

```
            if neighbour not in visited:
```

```
                visited.add(neighbour)
```

```
                queue.append(neighbour)
```

```
if __name__ == '__main__':
```

```
graph = {0: [1, 2], 1: [2], 2: [3], 3: [1, 2]}
```

```
print("Following is Breadth First Traversal: ")
```

```
bfs(graph, 0)
```

Output:

Following is Breadth First Traversal:

0 1 2 3

Program 3:

```
import heapq
```

```
class Solution(object):
```

```
    #:type n: integer
```

```
    #:return type: integer
```

```
    def nth_Ugly_Number(self, n):
```

```
        ugly_num = 0
```

```
        heap = []
```

```
        heapq.heappush(heap, 1)
```

```
        for _ in range(n):
```

```
            ugly_num = heapq.heappop(heap)
```

```
            if ugly_num % 2 == 0:
```

```
                heapq.heappush(heap, ugly_num * 2)
```

```
            elif ugly_num % 3 == 0:
```

```
                heapq.heappush(heap, ugly_num * 3)
```

```
            else:
```

```
                heapq.heappush(heap, ugly_num * 2)
```

```
                heapq.heappush(heap, ugly_num * 3)
```

```
                heapq.heappush(heap, ugly_num * 5)
```

```
        return ugly_num

n = 7

S = Solution()

result = S.nth_Ugly_Number(n)

print("7th Ugly number:")

print(result)

n = 10

result = S.nth_Ugly_Number(n)

print("\n10th Ugly number:")

print(result)
```

Output:

7th Ugly number:

9

10th Ugly number:

16

4) Python Program to calculate sum of series $1^2+2^2+3^2+.....+N^2$ using recursion

```
def sum_of_square_series(number):
```

```
    if(number == 0):
```

```
        return 0
```

```
    else:
```

```
        return (number * number) + sum_of_square_series(number - 1)
```

```
num = int(input("Please Enter any Positive Number : "))

total = sum_of_square_series(num)


print("The Sum of Series upto {0} = {1}".format(num, total))
```

Output:

```
Please Enter any Positive Number : 9

The Sum of Series upto 9 = 285
```

Program 5: Python program to find the k^{th} ($1 \leq k \leq \text{array's length}$) largest element in an unsorted array.

```
import heapq

class Solution(object):

    def find_Kth_Largest(self, nums, k):
        """
        :type nums: List[int]
        :type of k: int
        :return value type: int
        """
        h = []

        for e in nums:
            heapq.heappush(h, (-e, e))

        for i in range(k):
            w, e = heapq.heappop(h)

            if i == k - 1:
                return e
```

```

arr_nums = [12, 14, 9, 50, 61, 41]

s = Solution()

result = s.find_Kth_Largest(arr_nums, 3)

print("Third largest element:",result)

result = s.find_Kth_Largest(arr_nums, 2)

print("\nSecond largest element:",result)

result = s.find_Kth_Largest(arr_nums, 5)

print("\nFifth largest element:",result)

```

Output:

Third largest element: 41

Second largest element: 50

Fifth largest element: 12

Program 6: Python program to print a heap as a tree-like data structure.

```

import math

from io import StringIO

#source https://bit.ly/38HXSoU

def show_tree(tree, total_width=60, fill=' '):

    """Pretty-print a tree.

    total_width depends on your input size"""

    output = StringIO()

    last_row = -1

    for i, n in enumerate(tree):

```

```
    if i:
        row = int(math.floor(math.log(i+1, 2)))
    else:
        row = 0
    if row != last_row:
        output.write('\n')
    columns = 2**row
    col_width = int(math.floor((total_width * 1.0) / columns))
    output.write(str(n).center(col_width, fill))
    last_row = row
print (output.getvalue())
print ('-' * total_width)
return
```

#test

```
import heapq
```

```
heap = []
```

```
heapq.heappush(heap, 1)
```

```
heapq.heappush(heap, 2)
```

```
heapq.heappush(heap, 3)
```

```
heapq.heappush(heap, 4)
```

```
heapq.heappush(heap, 7)
```

```
heapq.heappush(heap, 9)
```

```
heapq.heappush(heap, 10)
```

```
heapq.heappush(heap, 8)
```

```
heapq.heappush(heap, 16)
heapq.heappush(heap, 14)
show_tree(heap)
```

Output:

```
      1
    2   3
  4   7  9  10
8  16  14
```

Program 7:

```
import turtle

def draw_bear():
    turtle.speed(2)

    turtle.bgcolor("lightblue")

    #Draw the bear's head

    turtle.penup()

    turtle.goto(0, -100)

    turtle.pendown()

    turtle.color("brown")

    turtle.begin_fill()

    turtle.circle(80)

    turtle.end_fill()

    #Draw the bear's ear

    turtle.penup()
```



```
turtle.goto(-30, 50)
turtle.pendown()
turtle.color("brown")
turtle.begin_fill()
turtle.circle(20)
turtle.end_fill()
```

```
turtle.penup()
turtle.goto(30, 50)
turtle.pendown()
turtle.color("brown")
turtle.begin_fill()
turtle.circle(20)
turtle.end_fill()
```

Draw the bear's eyes

```
turtle.penup()
turtle.goto(-20, 10)
turtle.pendown()
turtle.color("black")
turtle.begin_fill()
turtle.circle(8)
turtle.end_fill()
```

```
turtle.penup()
```

```
turtle.goto(20, 10)

turtle.pendown()

turtle.color("black")

turtle.begin_fill()

turtle.circle(8)

turtle.end_fill()

#Draw the bear's nose

turtle.penup()

turtle.goto(0, -5)

turtle.pendown()

turtle.color("black")

turtle.begin_fill()

turtle.circle(3)

turtle.end_fill()

#Draw the bear's Smiling mouth

turtle.penup()

turtle.goto(-20, -20)

turtle.pendown()

turtle.color("black")

turtle.width(3)

turtle.right(90)

turtle.circle(20, 180) # #Draw the semicircle for a smile

# Hide the turtle

turtle.hideturtle()

# Keep the window open
```

```
turtle.done()

#Draw the bear

draw_bear()
```

Output:



Program 8: Python program to find out common items from two dictionary

```
keys1 = []

vals1 = []

num1 = int(input("Enter the Number of elements for Dictionary-1: "))

print("Enter Values for Keys")

for i in range(0, num1):

    x = str(input("Enter Key " + str(i + 1) + "="))

    keys1.append(x)

print("Enter Values for Values")

for i in range(0, num1):

    x = str(input("Enter Value "+ str(i + 1) + "="))

    vals1.append(x)

dict1 = dict(zip(keys1, vals1))

print("Dictionary_1 Items:", dict1)
```

```
set1 = set(dict1.keys())

keys2 = []

vals2 = []

num2 = int(input("Enter the Number of elements for Dictionary-2: "))

print("Enter Values for Keys")

for i in range(0, num2):

    y = str(input("Enter Key " + str(i + 1) + "="))

    keys2.append(y)

print("Enter Values for Values")

for i in range(0, num2):

    y = str(input("Enter Value " + str(i + 1) + "="))

    vals2.append(y)

dict2= dict(zip(keys2, vals2))

print("Dictionary_2 Items:", dict2)

set2 = set(dict2.keys())

common_items = set1 & set2

print("Common items from dictionary 1 and dictionary 2:", common_items)
```

Output:

Enter the Number of elements for Dictionary-1: 4

Enter Values for Keys

Enter Key 1=Orange

Enter Key 2=Banana

Enter Key 3=Grape

Enter Key 4=Apple

Enter Values for Values

Enter Value 1=22

Enter Value 2=33

Enter Value 3=11

Enter Value 4=55

Dictionary_1 Items: {'Orange': '22', 'Banana': '33', 'Grape': '11', 'Apple': '55'}

Enter the Number of elements for Dictionary-2:

Program: 9: Python program to create a game under the concept of rock, paper and scissor

```
import random
```

```
def play_game():
```

```
    choices = ["rock", "paper", "scissors"]
```

```
    #Get user input for their choice
```

```
    user_choice = input("Enter your choice (rock, paper, or scissors): ").lower()
```

```
    # Validate user input
```

```
    if user_choice not in choices:
```

```
        print("Invalid choice. Please choose rock, paper, or scissors.")
```

```
        return
```

```
    # Computer randomly selects its choice
```

```
    computer_choice = random.choice(choices)
```

```
    # Display choices
```

```
    print(f"\nYou chose: {user_choice}")
```

```
    print(f"Computer chose: {computer_choice}\n")
```

```
    #Determine the winner
```

```
    if user_choice == computer_choice:
```

```
        print("It's a tie!")
    elif (
        (user_choice=="rock" and computer_choice=="scissors") or
        (user_choice=="paper" and computer_choice=="rock") or
        (user_choice=="scissors" and computer_choice=="paper")
    ):
        print("You win!")
    else:
        print("Computer wins!")
if __name__=="__main__":
    play_game()
```

Output:

Enter your choice (rock, paper, or scissors): rock

You chose: rock

Computer chose: rock

It's a tie!

Program 10: Python program to find k number of pairs (U, V) which consists of one element from the first array and one element from the second array using heap queue algorithm.