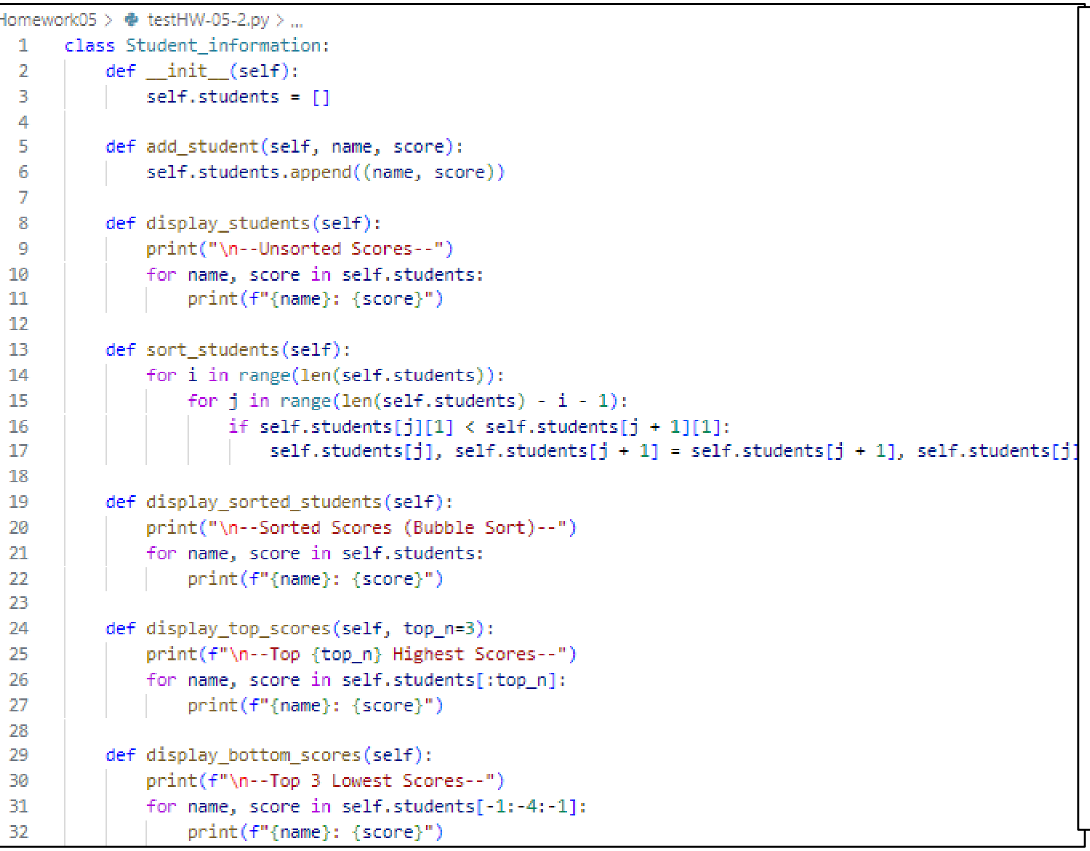
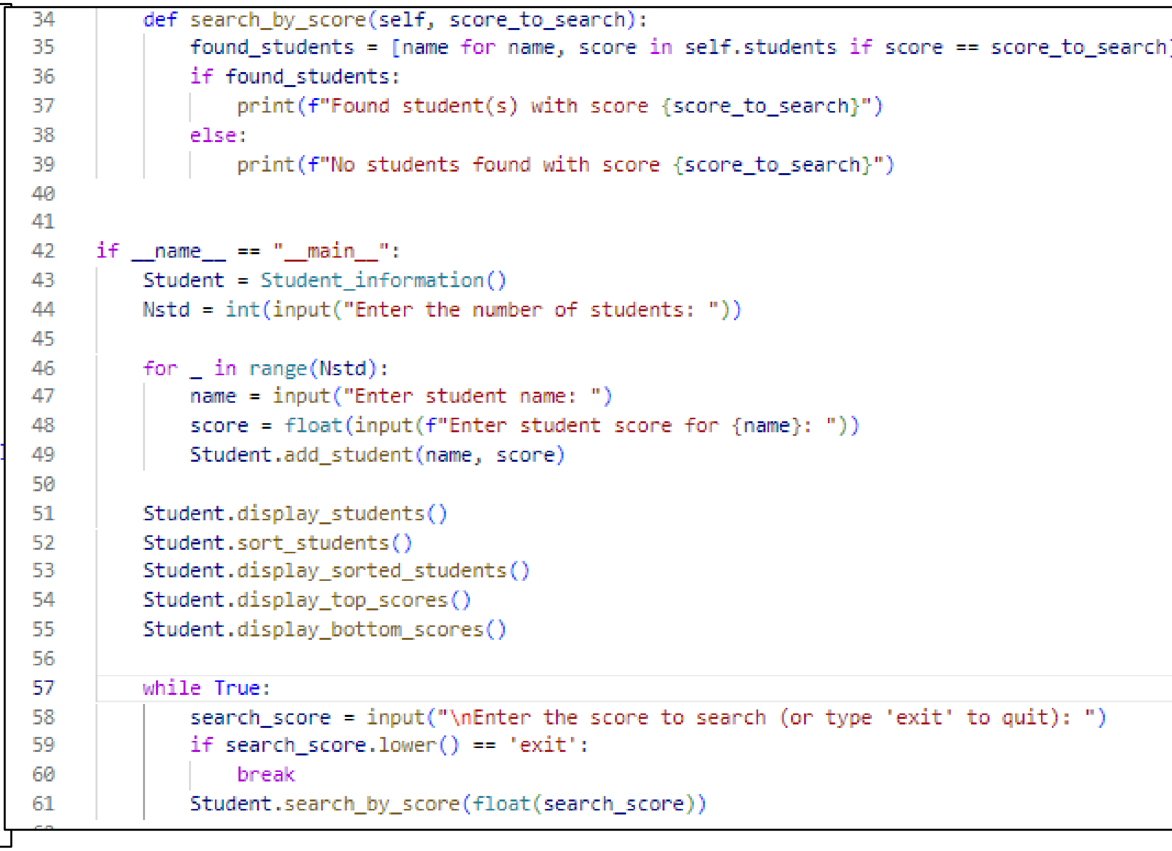
Homework 5

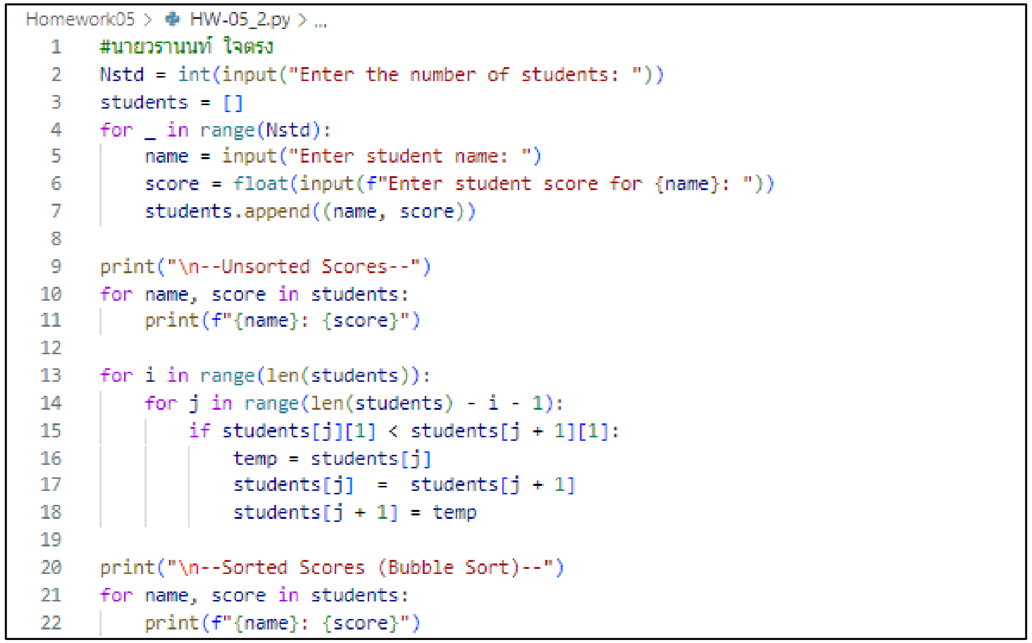


Homework05 > testHW-05-2.py > ...

```python
class Student_information:
    def __init__(self):
        self.students = []

    def add_student(self, name, score):
        self.students.append((name, score))

    def display_students(self):
        print("\n--Unsorted Scores--")
        for name, score in self.students:
            print(f"{name}: {score}")

    def sort_students(self):
        for i in range(len(self.students)):
            for j in range(len(self.students) - i - 1):
                if self.students[j][1] < self.students[j + 1][1]:
                    self.students[j], self.students[j + 1] = self.students[j + 1], self.students[j]

    def display_sorted_students(self):
        print("\n--Sorted Scores (Bubble Sort)--")
        for name, score in self.students:
            print(f"{name}: {score}")

    def display_top_scores(self, top_n=3):
        print(f"\n--Top {top_n} Highest Scores--")
        for name, score in self.students[:top_n]:
            print(f"{name}: {score}")

    def display_bottom_scores(self):
        print(f"\n--Top 3 Lowest Scores--")
        for name, score in self.students[-1:-4:-1]:
            print(f"{name}: {score}")
```

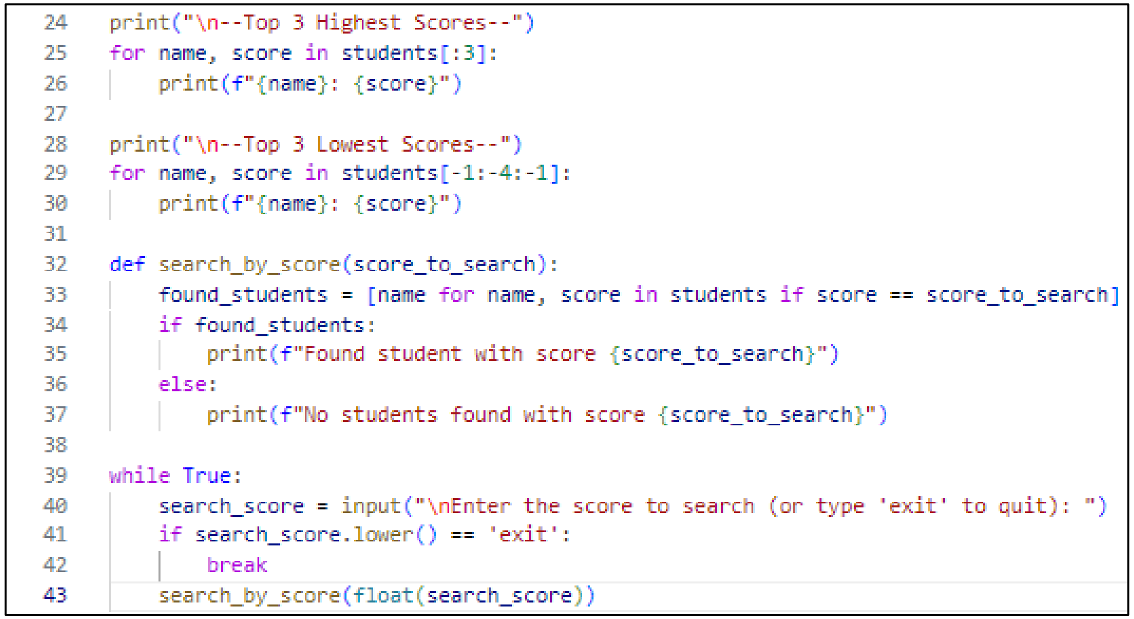


```python
    def search_by_score(self, score_to_search):
        found_students = [name for name, score in self.students if score == score_to_search
        if found_students:
            print(f"Found student(s) with score {score_to_search}")
        else:
            print(f"No students found with score {score_to_search}")


if __name__ == "__main__":
    Student = Student_information()
    Nstd = int(input("Enter the number of students: "))

    for _ in range(Nstd):
        name = input("Enter student name: ")
        score = float(input(f"Enter student score for {name}: "))
        Student.add_student(name, score)

    Student.display_students()
    Student.sort_students()
    Student.display_sorted_students()
    Student.display_top_scores()
    Student.display_bottom_scores()

    while True:
        search_score = input("\nEnter the score to search (or type 'exit' to quit): ")
        if search_score.lower() == 'exit':
            break
        Student.search_by_score(float(search_score))
```



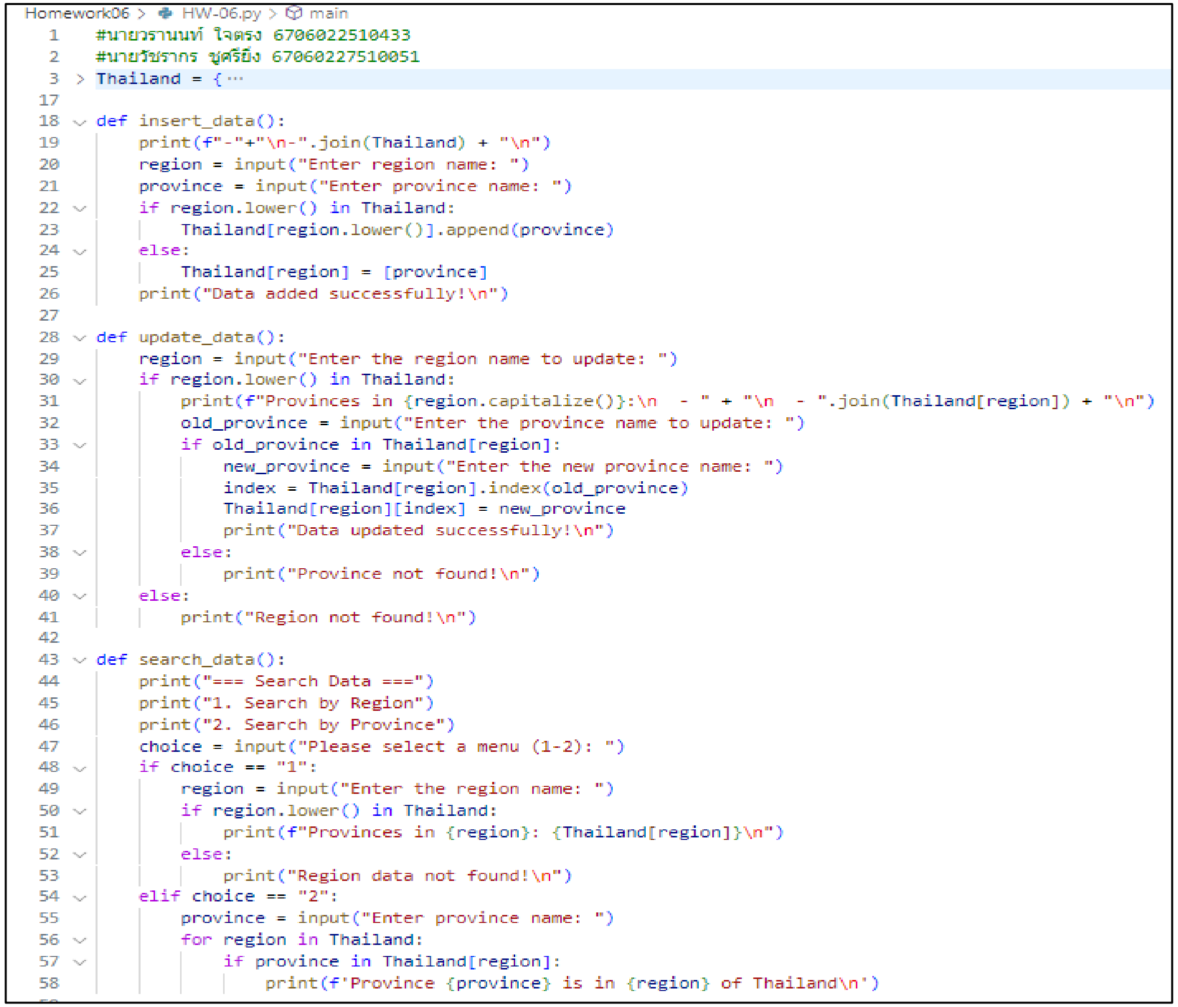
Homework05 > HW-05_2.py > ...

```python
#นายวรานนท์ ใจตรง
Nstd = int(input("Enter the number of students: "))
students = []
for _ in range(Nstd):
    name = input("Enter student name: ")
    score = float(input(f"Enter student score for {name}: "))
    students.append((name, score))

print("\n--Unsorted Scores--")
for name, score in students:
    print(f"{name}: {score}")

for i in range(len(students)):
    for j in range(len(students) - i - 1):
        if students[j][1] < students[j + 1][1]:
            temp = students[j]
            students[j]  =  students[j + 1]
            students[j + 1] = temp

print("\n--Sorted Scores (Bubble Sort)--")
for name, score in students:
    print(f"{name}: {score}")
```

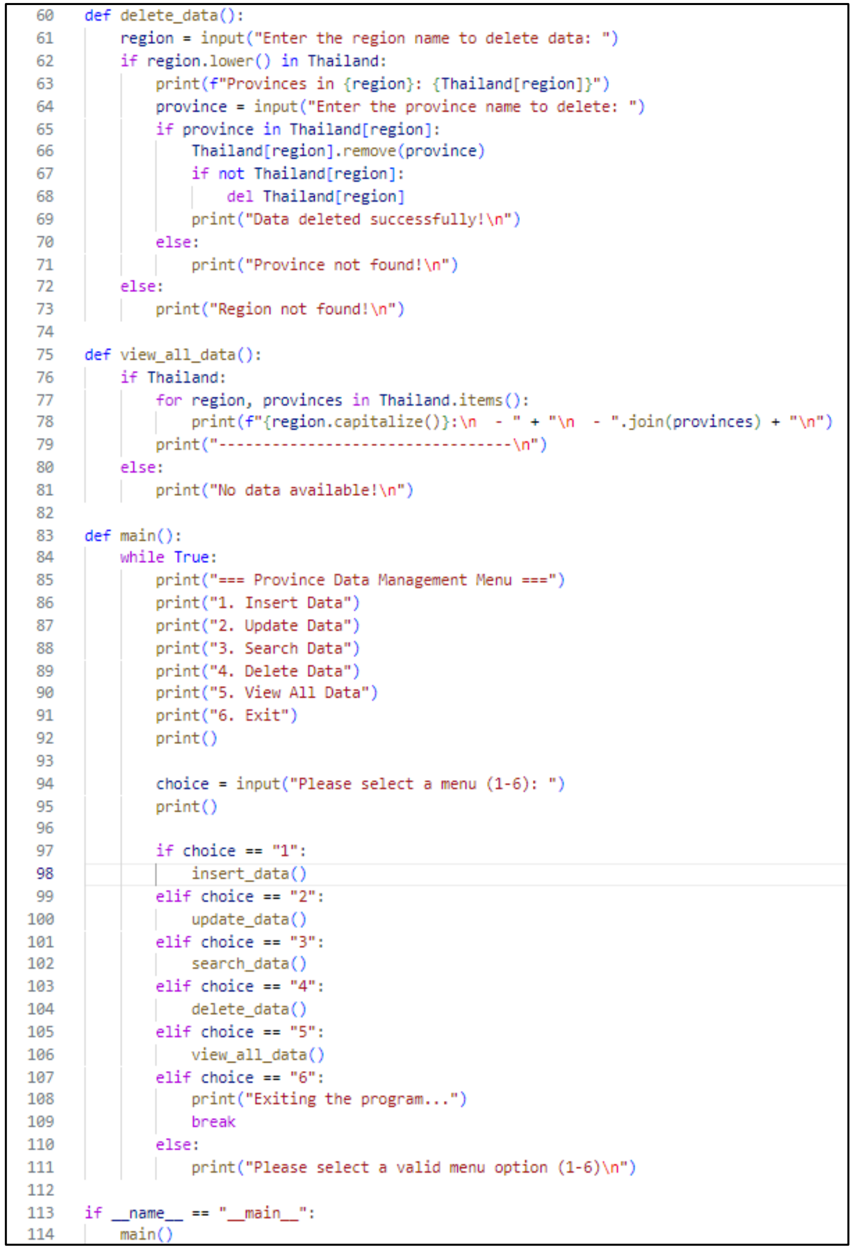


```python
print("\n--Top 3 Highest Scores--")
for name, score in students[:3]:
    print(f"{name}: {score}")

print("\n--Top 3 Lowest Scores--")
for name, score in students[-1:-4:-1]:
    print(f"{name}: {score}")

def search_by_score(score_to_search):
    found_students = [name for name, score in students if score == score_to_search]
    if found_students:
        print(f"Found student with score {score_to_search}")
    else:
        print(f"No students found with score {score_to_search}")

while True:
    search_score = input("\nEnter the score to search (or type 'exit' to quit): ")
    if search_score.lower() == 'exit':
        break
    search_by_score(float(search_score))
```

Homework 6



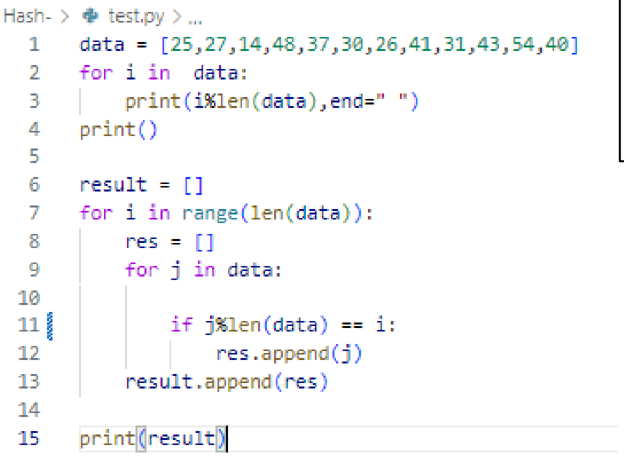
```python
#นายวรานนท์ ใจตรง 6706022510433
#นายวัชรากร ชูศรียิ่ง 67060227510051
Thailand = {···

def insert_data():
    print(f"-"+"\n-".join(Thailand) + "\n")
    region = input("Enter region name: ")
    province = input("Enter province name: ")
    if region.lower() in Thailand:
        Thailand[region.lower()].append(province)
    else:
        Thailand[region] = [province]
    print("Data added successfully!\n")

def update_data():
    region = input("Enter the region name to update: ")
    if region.lower() in Thailand:
        print(f"Provinces in {region.capitalize()}:\n  - " + "\n  - ".join(Thailand[region]) + "\n")
        old_province = input("Enter the province name to update: ")
        if old_province in Thailand[region]:
            new_province = input("Enter the new province name: ")
            index = Thailand[region].index(old_province)
            Thailand[region][index] = new_province
            print("Data updated successfully!\n")
        else:
            print("Province not found!\n")
    else:
        print("Region not found!\n")

def search_data():
    print("=== Search Data ===")
    print("1. Search by Region")
    print("2. Search by Province")
    choice = input("Please select a menu (1-2): ")
    if choice == "1":
        region = input("Enter the region name: ")
        if region.lower() in Thailand:
            print(f"Provinces in {region}: {Thailand[region]}\n")
        else:
            print("Region data not found!\n")
    elif choice == "2":
        province = input("Enter province name: ")
        for region in Thailand:
            if province in Thailand[region]:
                print(f'Province {province} is in {region} of Thailand\n')
```



```python
def delete_data():
    region = input("Enter the region name to delete data: ")
    if region.lower() in Thailand:
        print(f"Provinces in {region}: {Thailand[region]}")
        province = input("Enter the province name to delete: ")
        if province in Thailand[region]:
            Thailand[region].remove(province)
            if not Thailand[region]:
                del Thailand[region]
            print("Data deleted successfully!\n")
        else:
            print("Province not found!\n")
    else:
        print("Region not found!\n")

def view_all_data():
    if Thailand:
        for region, provinces in Thailand.items():
            print(f"{region.capitalize()}:\n  - " + "\n  - ".join(provinces) + "\n")
        print("--------------------------------\n")
    else:
        print("No data available!\n")

def main():
    while True:
        print("=== Province Data Management Menu ===")
        print("1. Insert Data")
        print("2. Update Data")
        print("3. Search Data")
        print("4. Delete Data")
        print("5. View All Data")
        print("6. Exit")
        print()

        choice = input("Please select a menu (1-6): ")
        print()

        if choice == "1":
            insert_data()
        elif choice == "2":
            update_data()
        elif choice == "3":
            search_data()
        elif choice == "4":
            delete_data()
        elif choice == "5":
            view_all_data()
        elif choice == "6":
            print("Exiting the program...")
            break
        else:
            print("Please select a valid menu option (1-6)\n")

if __name__ == "__main__":
    main()
```

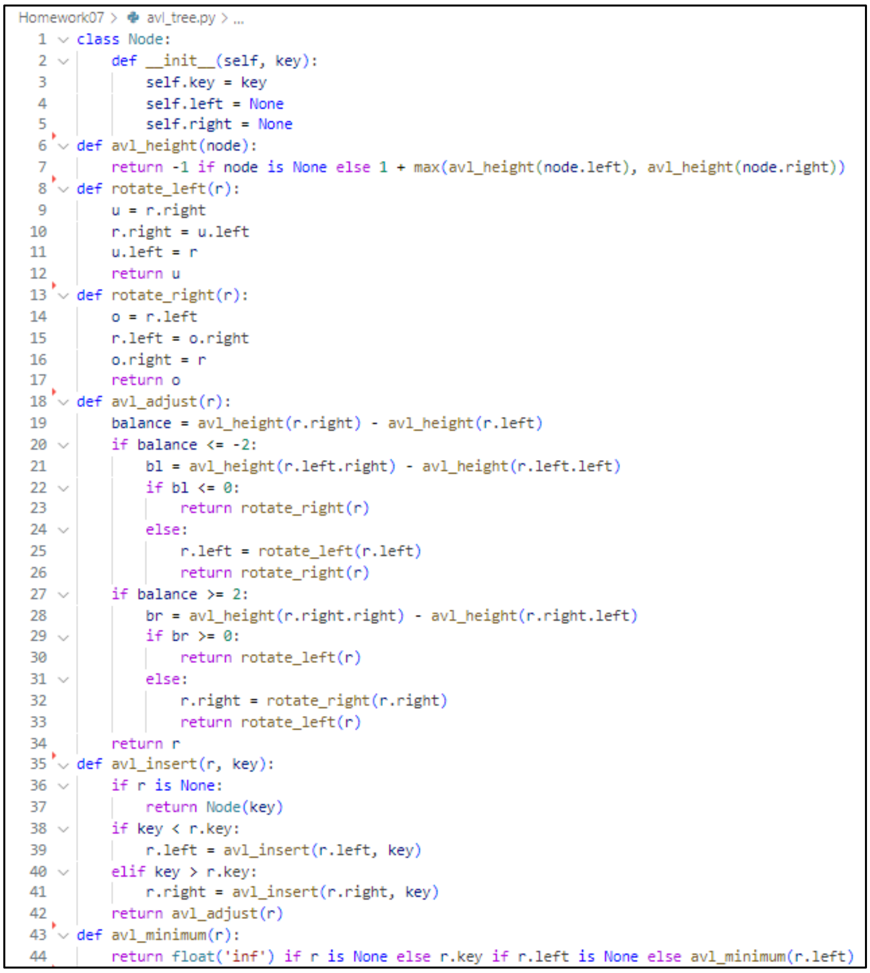
โค้ดช่วย Hash

ใช้ mod ข้อมูลทีละตัว



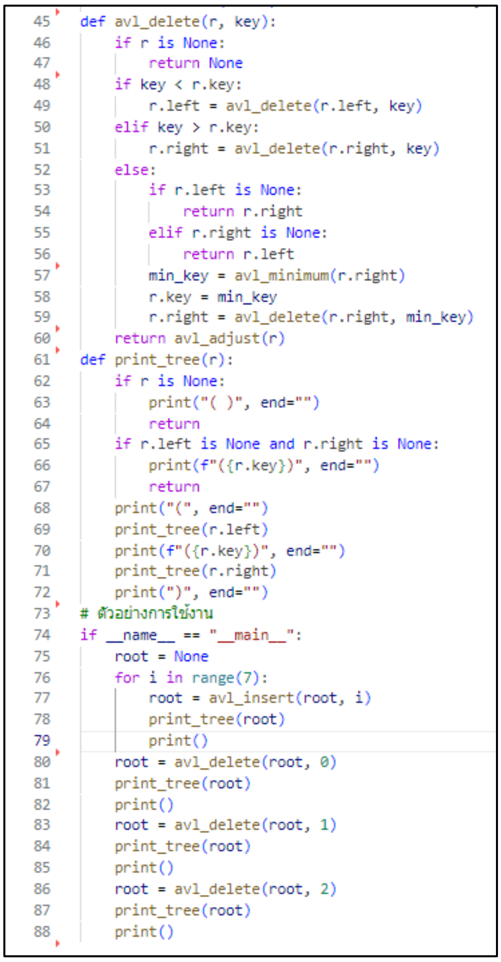
```python
data = [25,27,14,48,37,30,26,41,31,43,54,40]
for i in  data:
    print(i%len(data),end=" ")
print()

result = []
for i in range(len(data)):
    res = []
    for j in data:

        if j%len(data) == i:
            res.append(j)
    result.append(res)

print(result)
```

AVL Tree



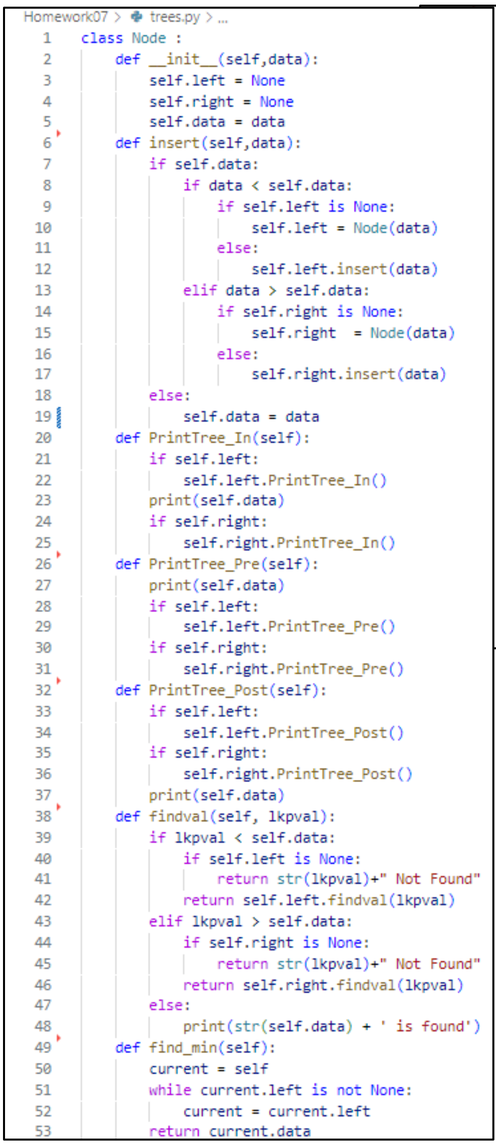
Homework07 > avl_tree.py > ...

```python
class Node:
    def __init__(self, key):
        self.key = key
        self.left = None
        self.right = None
def avl_height(node):
    return -1 if node is None else 1 + max(avl_height(node.left), avl_height(node.right))
def rotate_left(r):
    u = r.right
    r.right = u.left
    u.left = r
    return u
def rotate_right(r):
    o = r.left
    r.left = o.right
    o.right = r
    return o
def avl_adjust(r):
    balance = avl_height(r.right) - avl_height(r.left)
    if balance <= -2:
        bl = avl_height(r.left.right) - avl_height(r.left.left)
        if bl <= 0:
            return rotate_right(r)
        else:
            r.left = rotate_left(r.left)
            return rotate_right(r)
    if balance >= 2:
        br = avl_height(r.right.right) - avl_height(r.right.left)
        if br >= 0:
            return rotate_left(r)
        else:
            r.right = rotate_right(r.right)
            return rotate_left(r)
    return r
def avl_insert(r, key):
    if r is None:
        return Node(key)
    if key < r.key:
        r.left = avl_insert(r.left, key)
    elif key > r.key:
        r.right = avl_insert(r.right, key)
    return avl_adjust(r)
def avl_minimum(r):
    return float('inf') if r is None else r.key if r.left is None else avl_minimum(r.left)
```



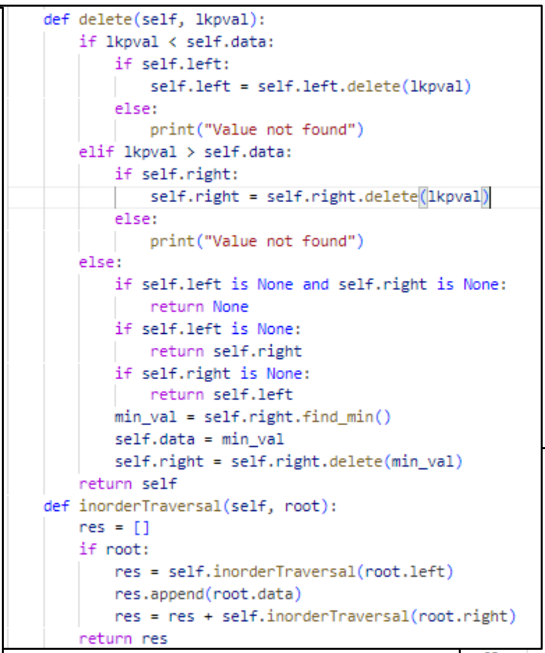
```python
def avl_delete(r, key):
    if r is None:
        return None
    if key < r.key:
        r.left = avl_delete(r.left, key)
    elif key > r.key:
        r.right = avl_delete(r.right, key)
    else:
        if r.left is None:
            return r.right
        elif r.right is None:
            return r.left
        min_key = avl_minimum(r.right)
        r.key = min_key
        r.right = avl_delete(r.right, min_key)
    return avl_adjust(r)
def print_tree(r):
    if r is None:
        print("( )", end="")
        return
    if r.left is None and r.right is None:
        print(f"({r.key})", end="")
        return
    print("(", end="")
    print_tree(r.left)
    print(f"({r.key})", end="")
    print_tree(r.right)
    print(")", end="")
# ตัวอย่างการใช้งาน
if __name__ == "__main__":
    root = None
    for i in range(7):
        root = avl_insert(root, i)
        print_tree(root)
        print()
    root = avl_delete(root, 0)
    print_tree(root)
    print()
    root = avl_delete(root, 1)
    print_tree(root)
    print()
    root = avl_delete(root, 2)
    print_tree(root)
    print()
```

Trees

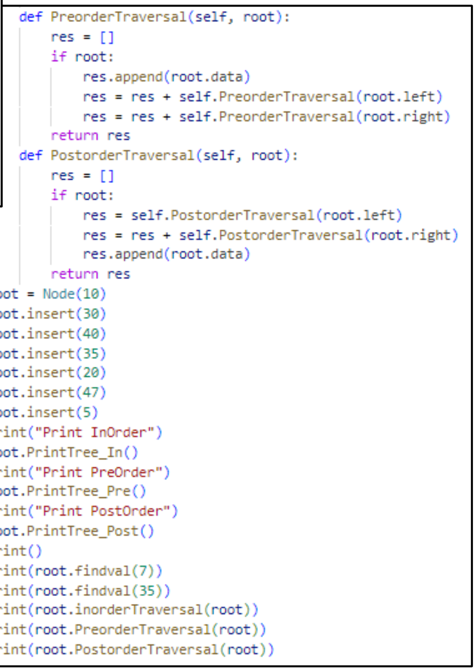


Homework07 > trees.py > ...

```python
class Node :
    def __init__(self,data):
        self.left = None
        self.right = None
        self.data = data
    def insert(self,data):
        if self.data:
            if data < self.data:
                if self.left is None:
                    self.left = Node(data)
                else:
                    self.left.insert(data)
            elif data > self.data:
                if self.right is None:
                    self.right  = Node(data)
                else:
                    self.right.insert(data)
        else:
            self.data = data
    def PrintTree_In(self):
        if self.left:
            self.left.PrintTree_In()
        print(self.data)
        if self.right:
            self.right.PrintTree_In()
    def PrintTree_Pre(self):
        print(self.data)
        if self.left:
            self.left.PrintTree_Pre()
        if self.right:
            self.right.PrintTree_Pre()
    def PrintTree_Post(self):
        if self.left:
            self.left.PrintTree_Post()
        if self.right:
            self.right.PrintTree_Post()
        print(self.data)
    def findval(self, lkpval):
        if lkpval < self.data:
            if self.left is None:
                return str(lkpval)+" Not Found"
            return self.left.findval(lkpval)
        elif lkpval > self.data:
            if self.right is None:
                return str(lkpval)+" Not Found"
            return self.right.findval(lkpval)
        else:
            print(str(self.data) + ' is found')
    def find_min(self):
        current = self
        while current.left is not None:
            current = current.left
        return current.data
```

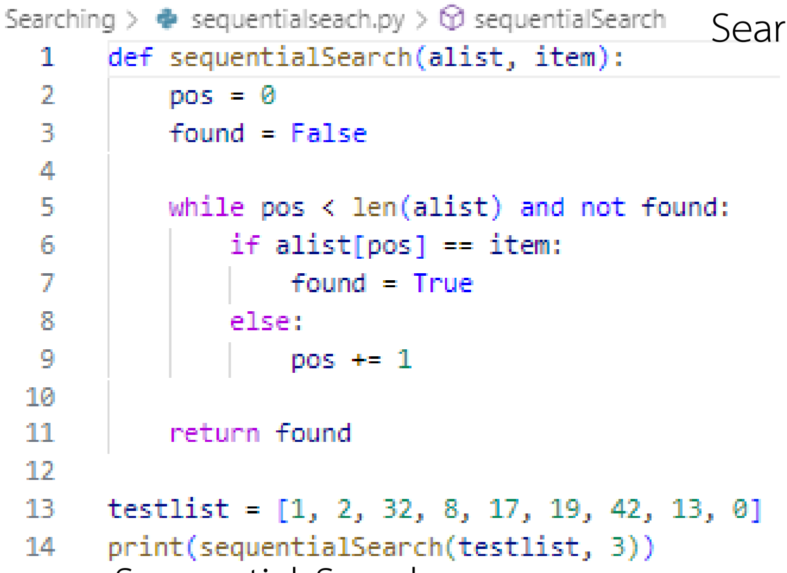


```python
    def delete(self, lkpval):
        if lkpval < self.data:
            if self.left:
                self.left = self.left.delete(lkpval)
            else:
                print("Value not found")
        elif lkpval > self.data:
            if self.right:
                self.right = self.right.delete(lkpval)
            else:
                print("Value not found")
        else:
            if self.left is None and self.right is None:
                return None
            if self.left is None:
                return self.right
            if self.right is None:
                return self.left
            min_val = self.right.find_min()
            self.data = min_val
            self.right = self.right.delete(min_val)
        return self
    def inorderTraversal(self, root):
        res = []
        if root:
            res = self.inorderTraversal(root.left)
            res.append(root.data)
            res = res + self.inorderTraversal(root.right)
        return res
```



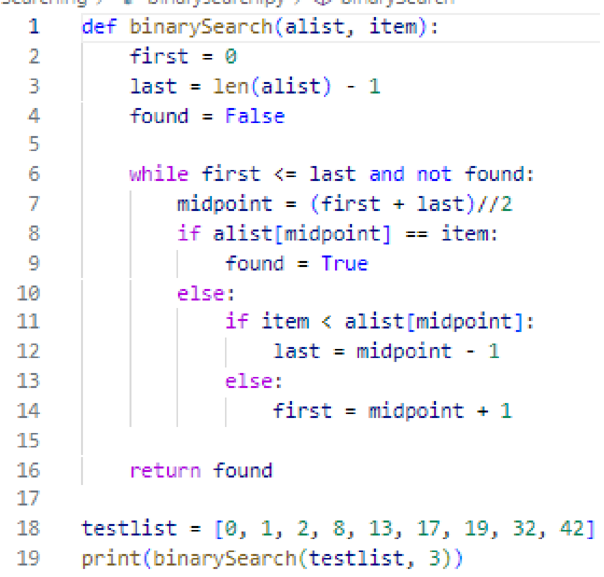
```python
    def PreorderTraversal(self, root):
        res = []
        if root:
            res.append(root.data)
            res = res + self.PreorderTraversal(root.left)
            res = res + self.PreorderTraversal(root.right)
        return res
    def PostorderTraversal(self, root):
        res = []
        if root:
            res = self.PostorderTraversal(root.left)
            res = res + self.PostorderTraversal(root.right)
            res.append(root.data)
        return res
root = Node(10)
root.insert(30)
root.insert(40)
root.insert(35)
root.insert(20)
root.insert(47)
root.insert(5)
print("Print InOrder")
root.PrintTree_In()
print("Print PreOrder")
root.PrintTree_Pre()
print("Print PostOrder")
root.PrintTree_Post()
print()
print(root.findval(7))
print(root.findval(35))
print(root.inorderTraversal(root))
print(root.PreorderTraversal(root))
print(root.PostorderTraversal(root))
```

Search



```python
def sequentialSearch(alist, item):
    pos = 0
    found = False

    while pos < len(alist) and not found:
        if alist[pos] == item:
            found = True
        else:
            pos += 1

    return found

testlist = [1, 2, 32, 8, 17, 19, 42, 13, 0]
print(sequentialSearch(testlist, 3))
```

Sequential Search



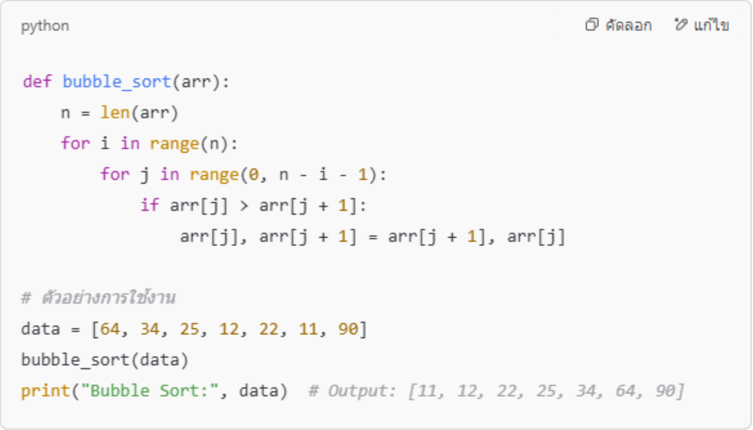
```python
def binarySearch(alist, item):
    first = 0
    last = len(alist) - 1
    found = False

    while first <= last and not found:
        midpoint = (first + last)//2
        if alist[midpoint] == item:
            found = True
        else:
            if item < alist[midpoint]:
                last = midpoint - 1
            else:
                first = midpoint + 1

    return found

testlist = [0, 1, 2, 8, 13, 17, 19, 32, 42]
print(binarySearch(testlist, 3))
```

Binary Search

Sorting

1. Bubble Sort

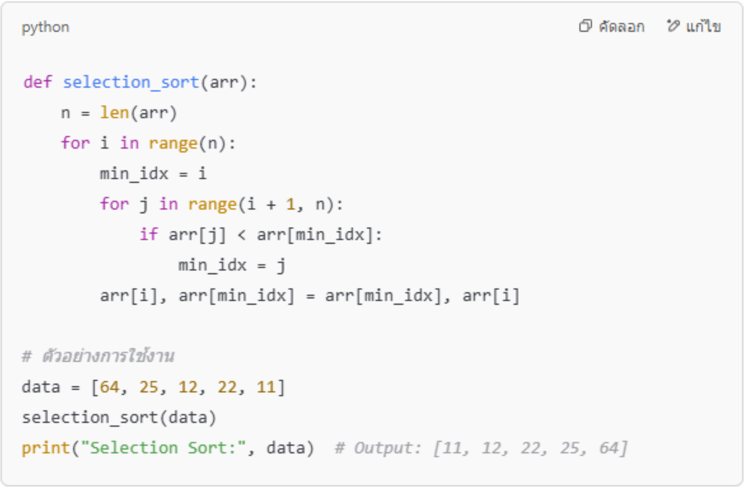
วิธีเปรียบเทียบข้อมูลใกล้เคียงกันทีละคู่ และสลับตำแหน่งถ้าจำเป็น ซ้ำไปเรื่อย ๆ จนกว่าข้อมูลทั้งหมดจะเรียงลำดับ



```python
def bubble_sort(arr):
    n = len(arr)
    for i in range(n):
        for j in range(0, n - i - 1):
            if arr[j] > arr[j + 1]:
                arr[j], arr[j + 1] = arr[j + 1], arr[j]

# ตัวอย่างการใช้งาน
data = [64, 34, 25, 12, 22, 11, 90]
bubble_sort(data)
print("Bubble Sort:", data)  # Output: [11, 12, 22, 25, 34, 64, 90]
```

2. Selection Sort

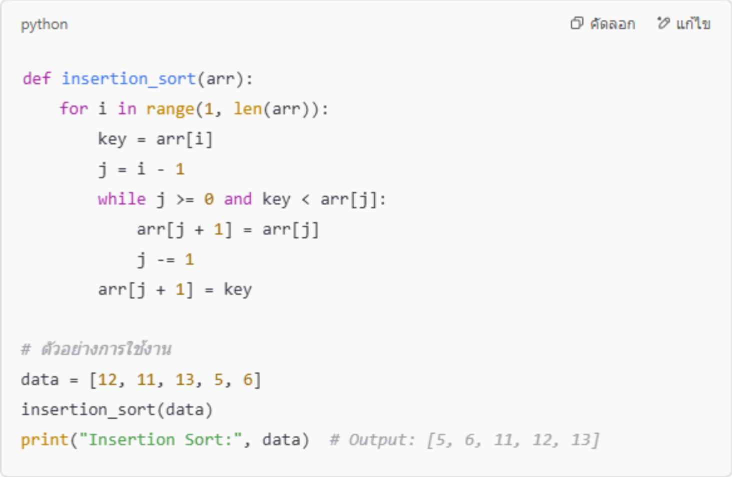
เลือกค่าที่เล็กที่สุดจากส่วนที่ยังไม่เรียงและสลับกับตำแหน่งแรกในส่วนที่ยังไม่เรียง



```python
def selection_sort(arr):
    n = len(arr)
    for i in range(n):
        min_idx = i
        for j in range(i + 1, n):
            if arr[j] < arr[min_idx]:
                min_idx = j
        arr[i], arr[min_idx] = arr[min_idx], arr[i]

# ตัวอย่างการใช้งาน
data = [64, 25, 12, 22, 11]
selection_sort(data)
print("Selection Sort:", data)  # Output: [11, 12, 22, 25, 64]
```

3. Insertion Sort

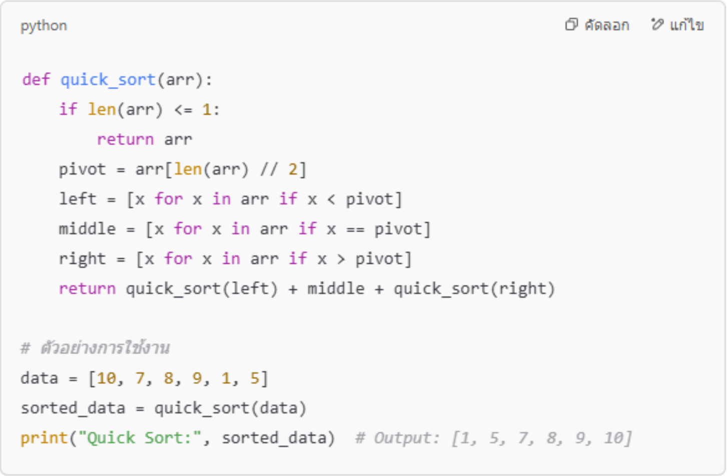
แทรกแต่ละค่าจากส่วนที่ยังไม่ได้เรียงไปยังตำแหน่งที่เหมาะสมในส่วนที่เรียงแล้ว



```python
def insertion_sort(arr):
    for i in range(1, len(arr)):
        key = arr[i]
        j = i - 1
        while j >= 0 and key < arr[j]:
            arr[j + 1] = arr[j]
            j -= 1
        arr[j + 1] = key

# ตัวอย่างการใช้งาน
data = [12, 11, 13, 5, 6]
insertion_sort(data)
print("Insertion Sort:", data)  # Output: [5, 6, 11, 12, 13]
```

5. Quick Sort

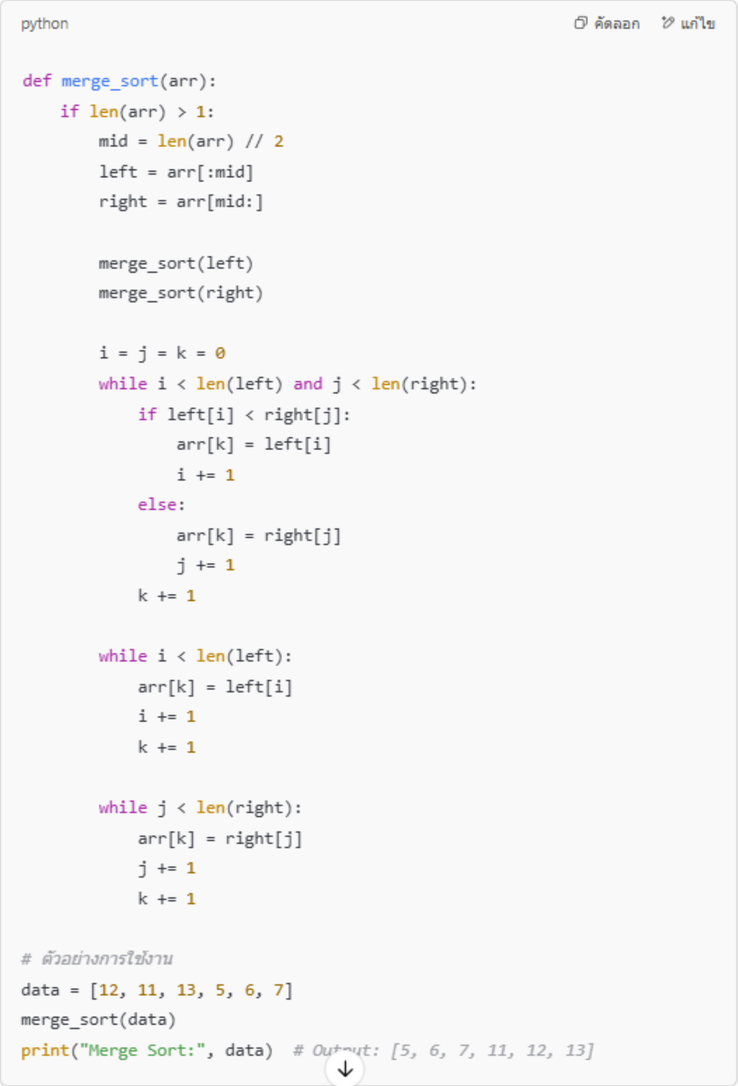
เลือกค่าหนึ่งเป็น pivot แล้วแบ่งข้อมูลตามค่าที่เล็กกว่าหรือใหญ่กว่า pivot



```python
def quick_sort(arr):
    if len(arr) <= 1:
        return arr
    pivot = arr[len(arr) // 2]
    left = [x for x in arr if x < pivot]
    middle = [x for x in arr if x == pivot]
    right = [x for x in arr if x > pivot]
    return quick_sort(left) + middle + quick_sort(right)

# ตัวอย่างการใช้งาน
data = [10, 7, 8, 9, 1, 5]
sorted_data = quick_sort(data)
print("Quick Sort:", sorted_data)  # Output: [1, 5, 7, 8, 9, 10]
```

4. Merge Sort

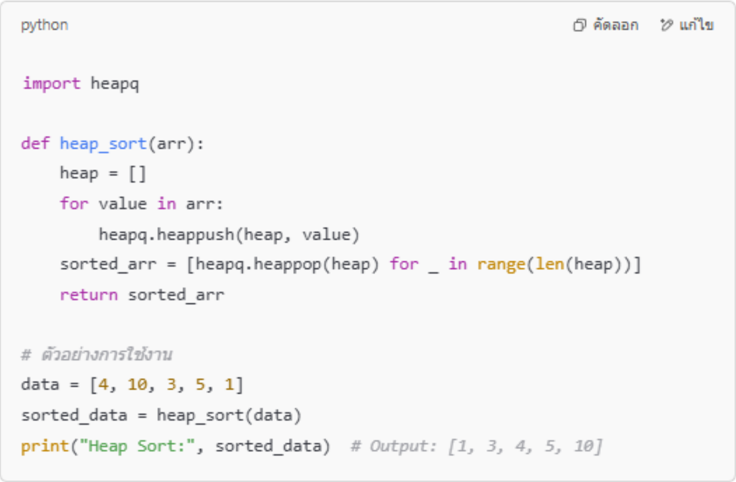
ใช้การแบ่งและรวม (Divide and Conquer)



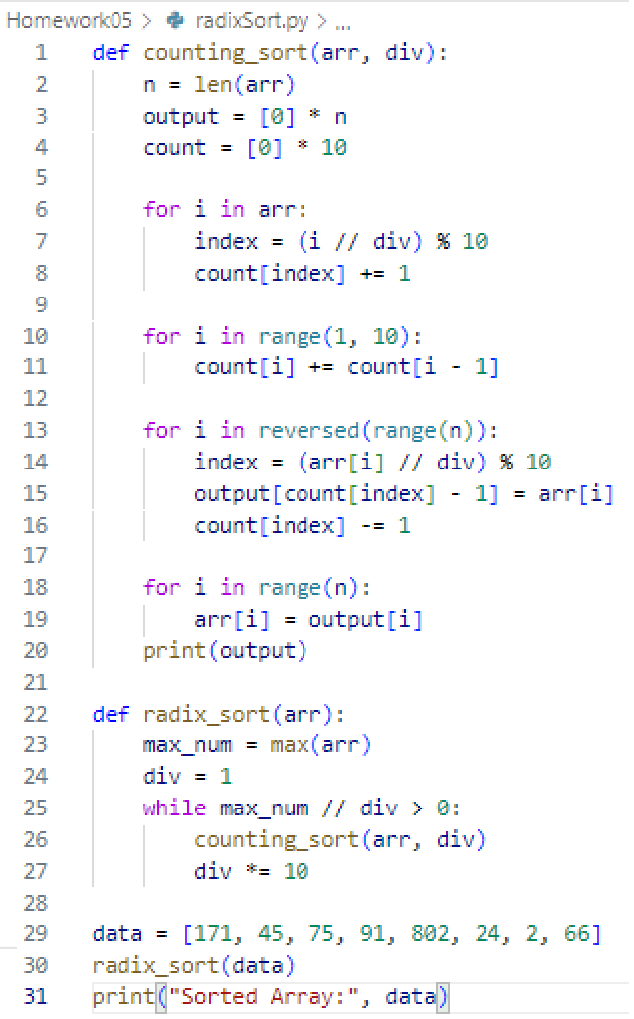
```python
def merge_sort(arr):
    if len(arr) > 1:
        mid = len(arr) // 2
        left = arr[:mid]
        right = arr[mid:]

        merge_sort(left)
        merge_sort(right)

        i = j = k = 0
        while i < len(left) and j < len(right):
            if left[i] < right[j]:
                arr[k] = left[i]
                i += 1
            else:
                arr[k] = right[j]
                j += 1
            k += 1

        while i < len(left):
            arr[k] = left[i]
            i += 1
            k += 1

        while j < len(right):
            arr[k] = right[j]
            j += 1
            k += 1

# ตัวอย่างการใช้งาน
data = [12, 11, 13, 5, 6, 7]
merge_sort(data)
print("Merge Sort:", data)  # Output: [5, 6, 7, 11, 12, 13]
```

6. Heap Sort

ใช้โครงสร้างข้อมูล heap

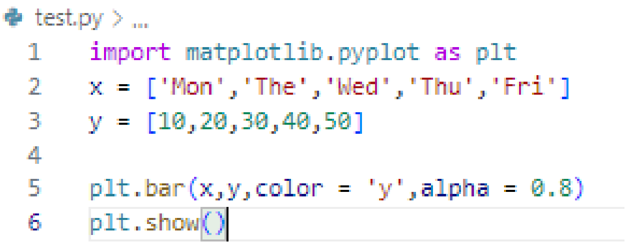


```python
import heapq

def heap_sort(arr):
    heap = []
    for value in arr:
        heapq.heappush(heap, value)
    sorted_arr = [heapq.heappop(heap) for _ in range(len(heap))]
    return sorted_arr

# ตัวอย่างการใช้งาน
data = [4, 10, 3, 5, 1]
sorted_data = heap_sort(data)
print("Heap Sort:", sorted_data)  # Output: [1, 3, 4, 5, 10]
```

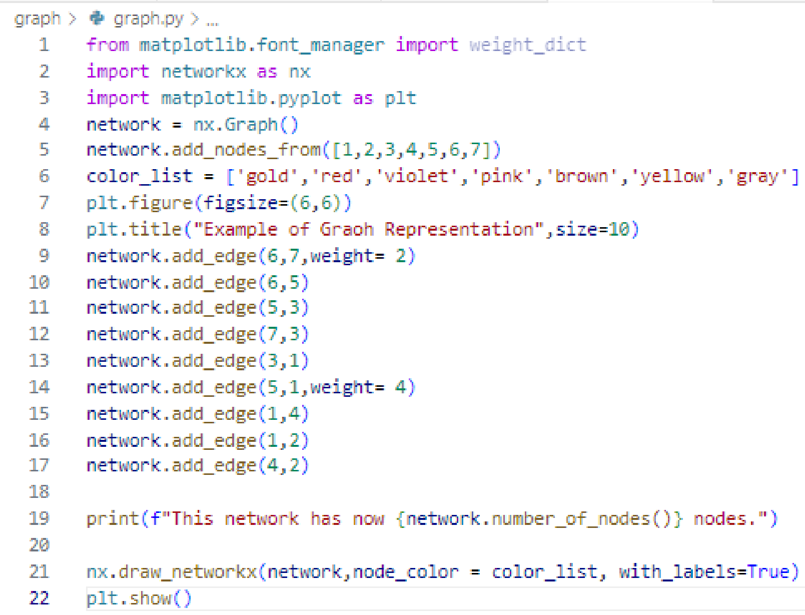


```python
def counting_sort(arr, div):
    n = len(arr)
    output = [0] * n
    count = [0] * 10

    for i in arr:
        index = (i // div) % 10
        count[index] += 1

    for i in range(1, 10):
        count[i] += count[i - 1]

    for i in reversed(range(n)):
        index = (arr[i] // div) % 10
        output[count[index] - 1] = arr[i]
        count[index] -= 1

    for i in range(n):
        arr[i] = output[i]
    print(output)

def radix_sort(arr):
    max_num = max(arr)
    div = 1
    while max_num // div > 0:
        counting_sort(arr, div)
        div *= 10

data = [171, 45, 75, 91, 802, 24, 2, 66]
radix_sort(data)
print("Sorted Array:", data)
```

Graph



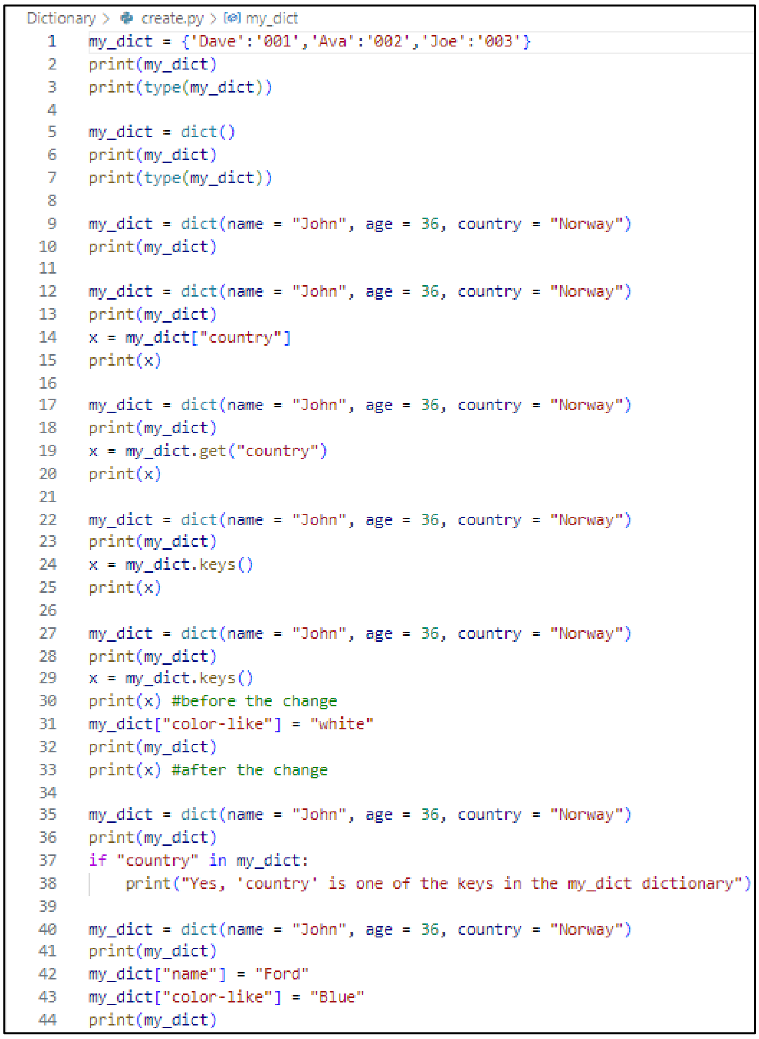
```python
import matplotlib.pyplot as plt
x = ['Mon','The','Wed','Thu','Fri']
y = [10,20,30,40,50]

plt.bar(x,y,color = 'y',alpha = 0.8)
plt.show()
```



```python
from matplotlib.font_manager import weight_dict
import networkx as nx
import matplotlib.pyplot as plt
network = nx.Graph()
network.add_nodes_from([1,2,3,4,5,6,7])
color_list = ['gold','red','violet','pink','brown','yellow','gray']
plt.figure(figsize=(6,6))
plt.title("Example of Graoh Representation",size=10)
network.add_edge(6,7,weight= 2)
network.add_edge(6,5)
network.add_edge(5,3)
network.add_edge(7,3)
network.add_edge(3,1)
network.add_edge(5,1,weight= 4)
network.add_edge(1,4)
network.add_edge(1,2)
network.add_edge(4,2)

print(f"This network has now {network.number_of_nodes()} nodes.")

nx.draw_networkx(network,node_color = color_list, with_labels=True)
plt.show()
```

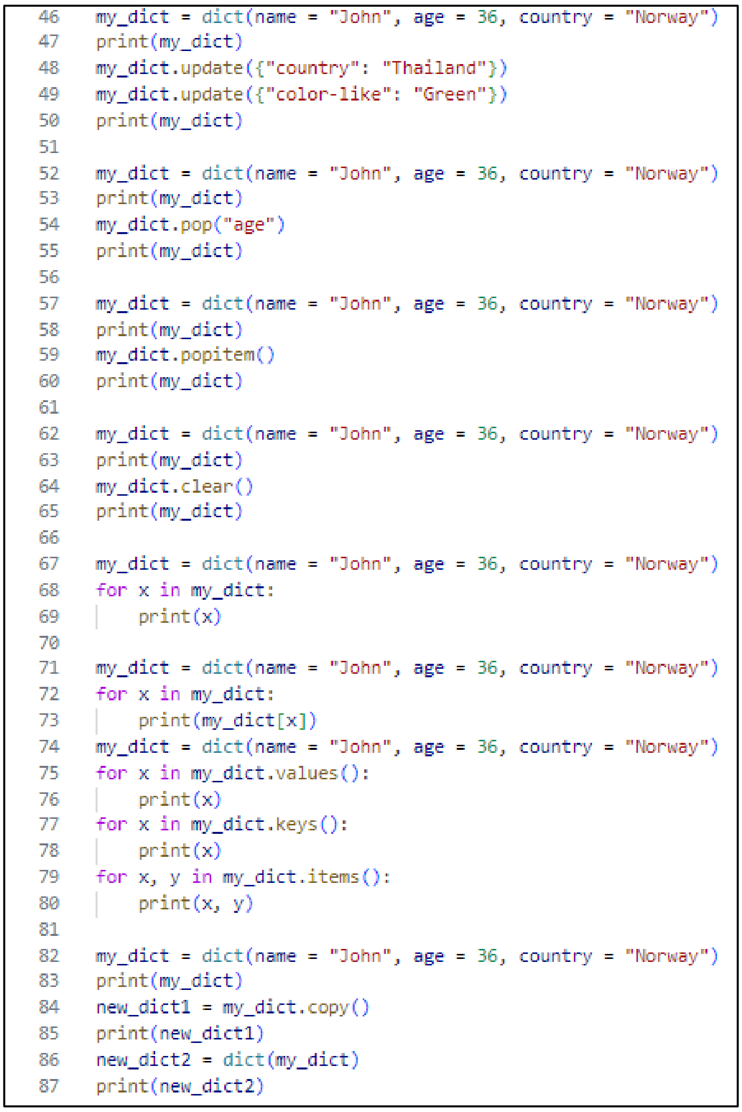
Dictionary

ตัวอย่างการใช้ Dict

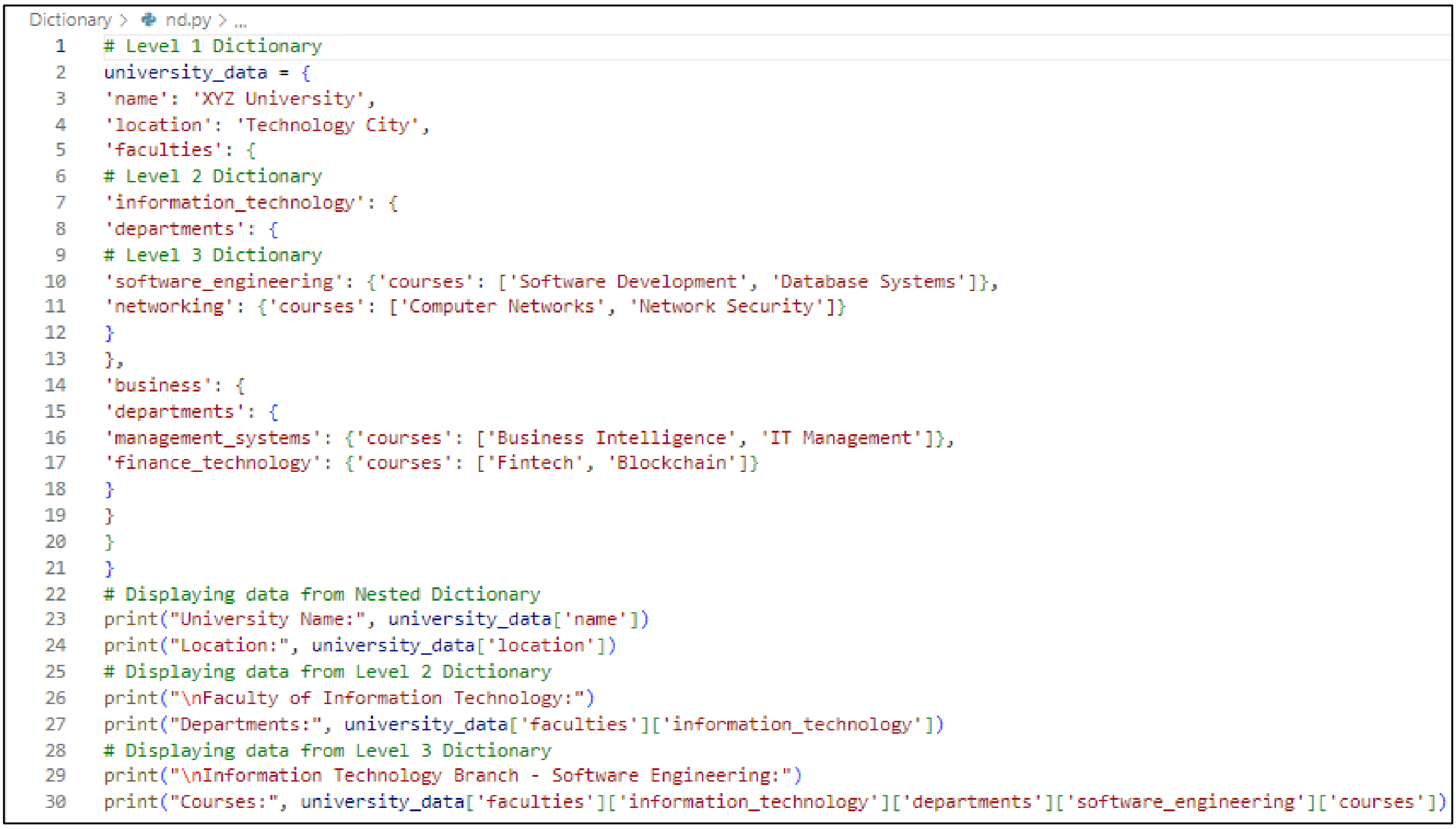


Dictionary > create.py > my_dict

```python
my_dict = {'Dave':'001','Ava':'002','Joe':'003'}
print(my_dict)
print(type(my_dict))

my_dict = dict()
print(my_dict)
print(type(my_dict))

my_dict = dict(name = "John", age = 36, country = "Norway")
print(my_dict)

my_dict = dict(name = "John", age = 36, country = "Norway")
print(my_dict)
x = my_dict["country"]
print(x)

my_dict = dict(name = "John", age = 36, country = "Norway")
print(my_dict)
x = my_dict.get("country")
print(x)

my_dict = dict(name = "John", age = 36, country = "Norway")
print(my_dict)
x = my_dict.keys()
print(x)

my_dict = dict(name = "John", age = 36, country = "Norway")
print(my_dict)
x = my_dict.keys()
print(x) #before the change
my_dict["color-like"] = "white"
print(my_dict)
print(x) #after the change

my_dict = dict(name = "John", age = 36, country = "Norway")
print(my_dict)
if "country" in my_dict:
    print("Yes, 'country' is one of the keys in the my_dict dictionary")

my_dict = dict(name = "John", age = 36, country = "Norway")
print(my_dict)
my_dict["name"] = "Ford"
my_dict["color-like"] = "Blue"
print(my_dict)
```



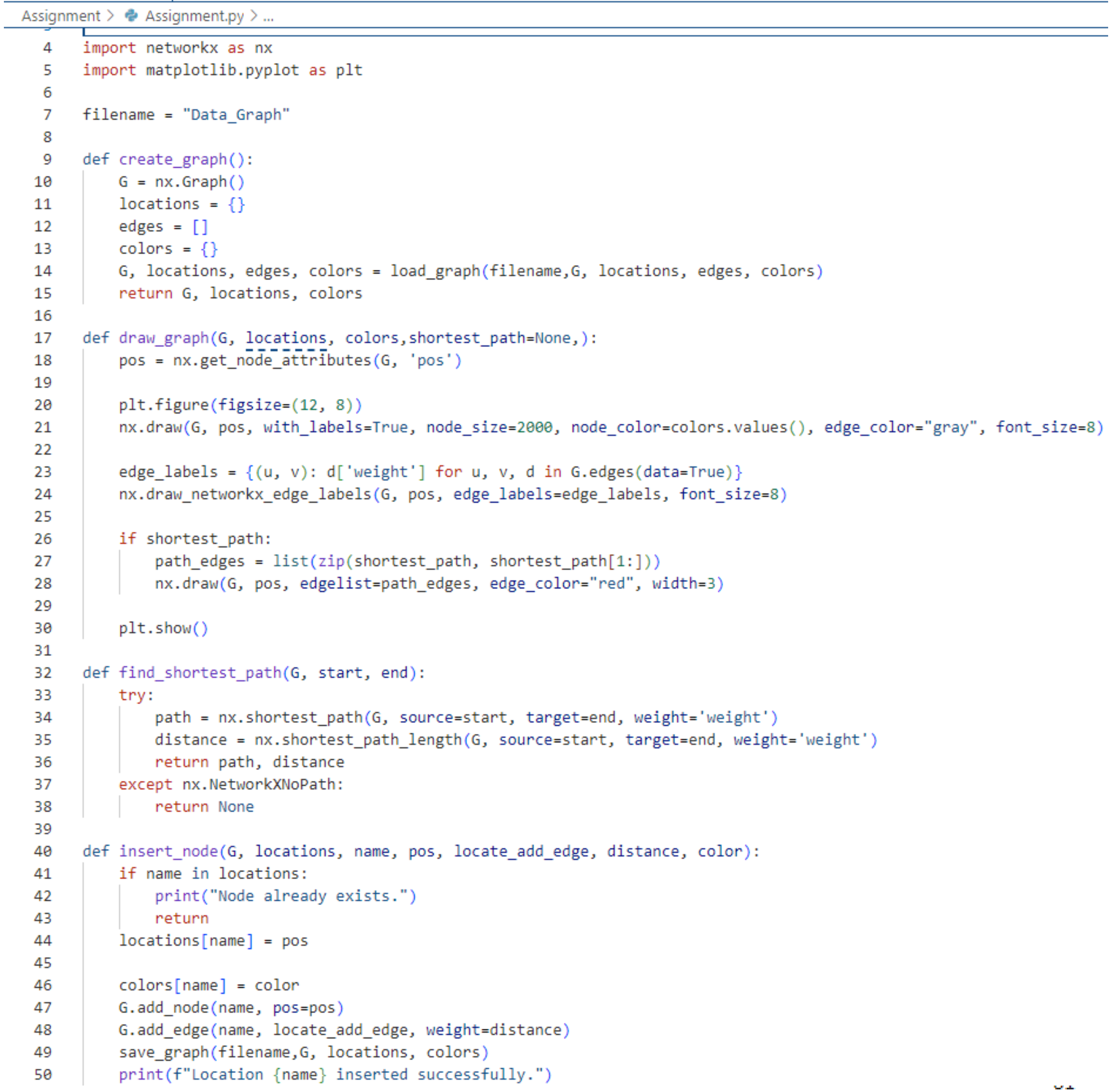
```python
my_dict = dict(name = "John", age = 36, country = "Norway")
print(my_dict)
my_dict.update({"country": "Thailand"})
my_dict.update({"color-like": "Green"})
print(my_dict)

my_dict = dict(name = "John", age = 36, country = "Norway")
print(my_dict)
my_dict.pop("age")
print(my_dict)

my_dict = dict(name = "John", age = 36, country = "Norway")
print(my_dict)
my_dict.popitem()
print(my_dict)

my_dict = dict(name = "John", age = 36, country = "Norway")
print(my_dict)
my_dict.clear()
print(my_dict)

my_dict = dict(name = "John", age = 36, country = "Norway")
for x in my_dict:
    print(x)

my_dict = dict(name = "John", age = 36, country = "Norway")
for x in my_dict:
    print(my_dict[x])
my_dict = dict(name = "John", age = 36, country = "Norway")
for x in my_dict.values():
    print(x)
for x in my_dict.keys():
    print(x)
for x, y in my_dict.items():
    print(x, y)

my_dict = dict(name = "John", age = 36, country = "Norway")
print(my_dict)
new_dict1 = my_dict.copy()
print(new_dict1)
new_dict2 = dict(my_dict)
print(new_dict2)
```



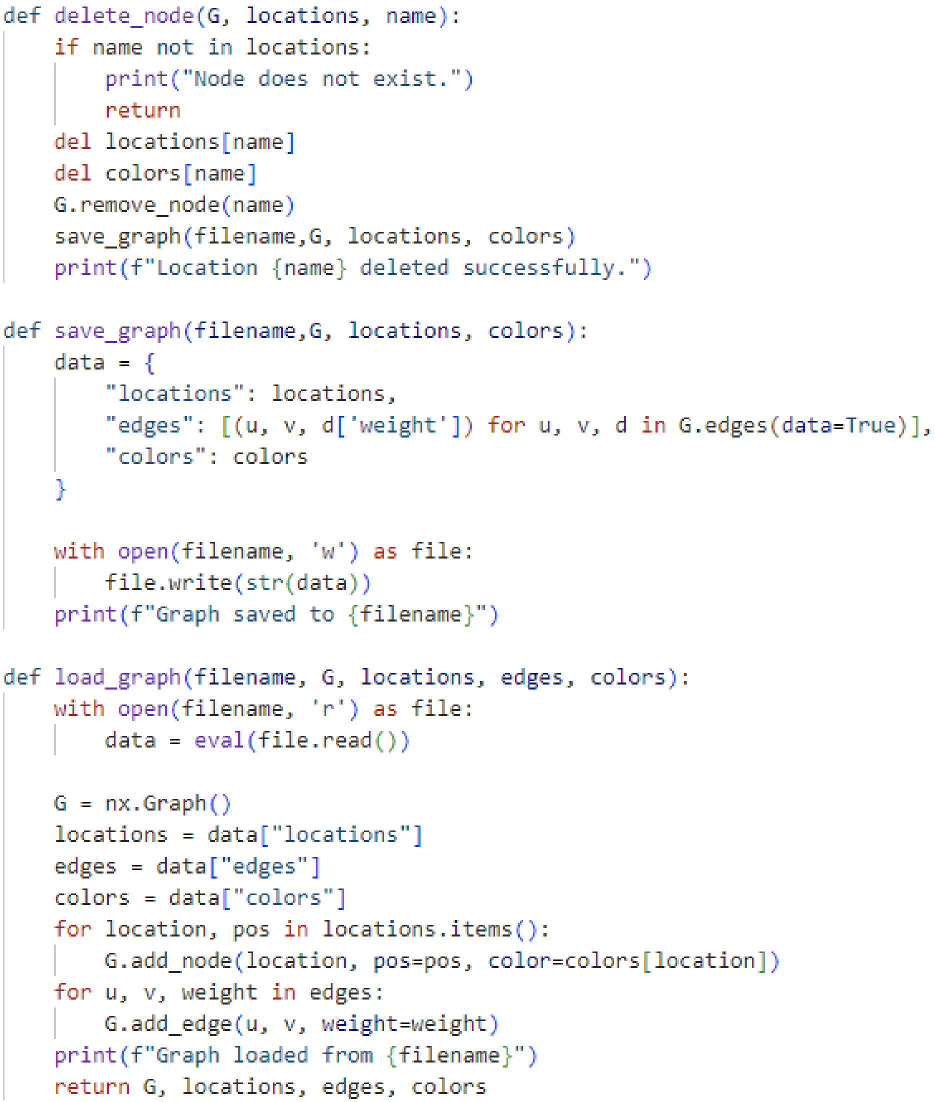
Dictionary > nd.py > ...

```python
# Level 1 Dictionary
university_data = {
'name': 'XYZ University',
'location': 'Technology City',
'faculties': {
# Level 2 Dictionary
'information_technology': {
'departments': {
# Level 3 Dictionary
'software_engineering': {'courses': ['Software Development', 'Database Systems']},
'networking': {'courses': ['Computer Networks', 'Network Security']}
}
},
'business': {
'departments': {
'management_systems': {'courses': ['Business Intelligence', 'IT Management']},
'finance_technology': {'courses': ['Fintech', 'Blockchain']}
}
}
}
}
# Displaying data from Nested Dictionary
print("University Name:", university_data['name'])
print("Location:", university_data['location'])
# Displaying data from Level 2 Dictionary
print("\nFaculty of Information Technology:")
print("Departments:", university_data['faculties']['information_technology'])
# Displaying data from Level 3 Dictionary
print("\nInformation Technology Branch - Software Engineering:")
print("Courses:", university_data['faculties']['information_technology']['departments']['software_engineering']['courses'])
```

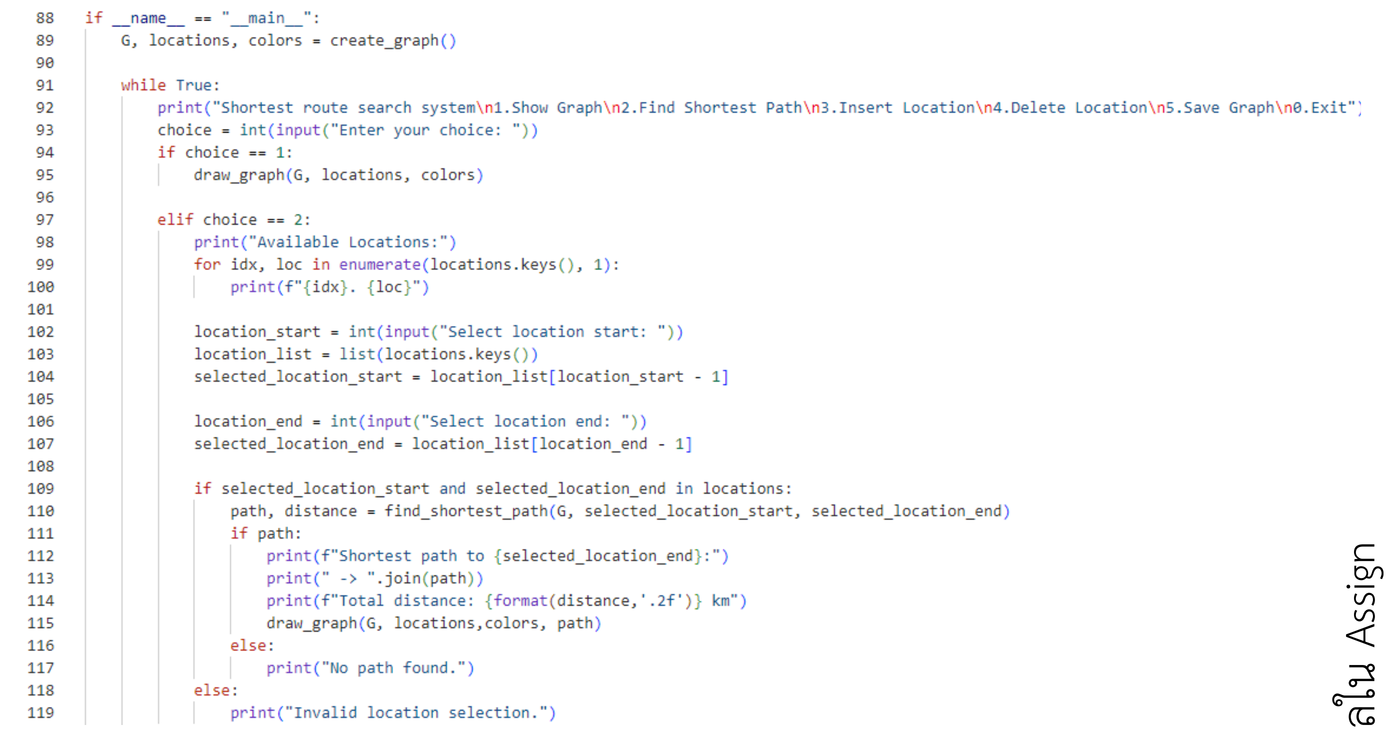
Assignment Graph


Assignment > Assignment.py > ...

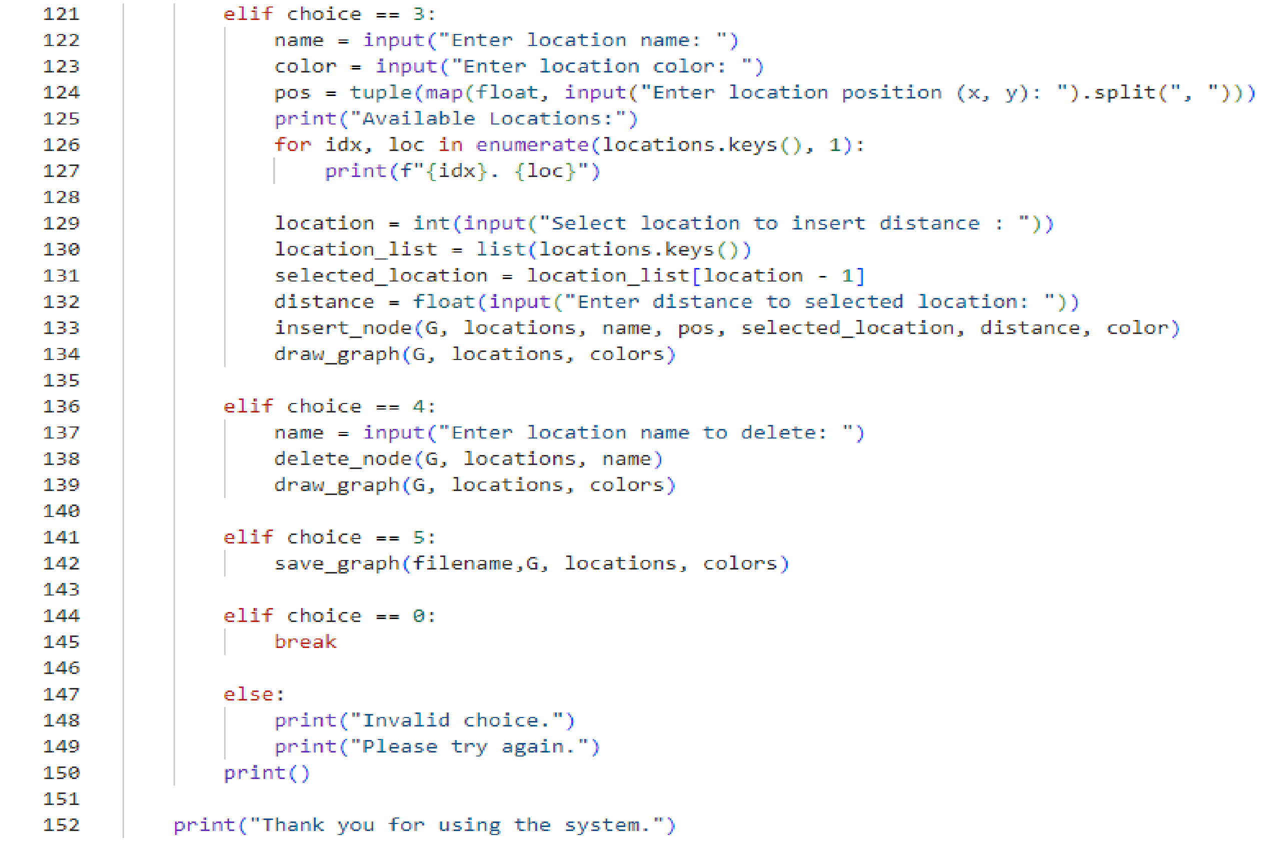
```python
import networkx as nx
import matplotlib.pyplot as plt

filename = "Data_Graph"

def create_graph():
    G = nx.Graph()
    locations = {}
    edges = []
    colors = {}
    G, locations, edges, colors = load_graph(filename,G, locations, edges, colors)
    return G, locations, colors

def draw_graph(G, locations, colors,shortest_path=None,):
    pos = nx.get_node_attributes(G, 'pos')

    plt.figure(figsize=(12, 8))
    nx.draw(G, pos, with_labels=True, node_size=2000, node_color=colors.values(), edge_color="gray", font_size=8)

    edge_labels = {(u, v): d['weight'] for u, v, d in G.edges(data=True)}
    nx.draw_networkx_edge_labels(G, pos, edge_labels=edge_labels, font_size=8)

    if shortest_path:
        path_edges = list(zip(shortest_path, shortest_path[1:]))
        nx.draw(G, pos, edgelist=path_edges, edge_color="red", width=3)

    plt.show()

def find_shortest_path(G, start, end):
    try:
        path = nx.shortest_path(G, source=start, target=end, weight='weight')
        distance = nx.shortest_path_length(G, source=start, target=end, weight='weight')
        return path, distance
    except nx.NetworkXNoPath:
        return None

def insert_node(G, locations, name, pos, locate_add_edge, distance, color):
    if name in locations:
        print("Node already exists.")
        return
    locations[name] = pos

    colors[name] = color
    G.add_node(name, pos=pos)
    G.add_edge(name, locate_add_edge, weight=distance)
    save_graph(filename,G, locations, colors)
    print(f"Location {name} inserted successfully.")
```



```python
def delete_node(G, locations, name):
    if name not in locations:
        print("Node does not exist.")
        return
    del locations[name]
    del colors[name]
    G.remove_node(name)
    save_graph(filename,G, locations, colors)
    print(f"Location {name} deleted successfully.")

def save_graph(filename,G, locations, colors):
    data = {
        "locations": locations,
        "edges": [(u, v, d['weight']) for u, v, d in G.edges(data=True)],
        "colors": colors
    }

    with open(filename, 'w') as file:
        file.write(str(data))
    print(f"Graph saved to {filename}")

def load_graph(filename, G, locations, edges, colors):
    with open(filename, 'r') as file:
        data = eval(file.read())

    G = nx.Graph()
    locations = data["locations"]
    edges = data["edges"]
    colors = data["colors"]
    for location, pos in locations.items():
        G.add_node(location, pos=pos, color=colors[location])
    for u, v, weight in edges:
        G.add_edge(u, v, weight=weight)
    print(f"Graph loaded from {filename}")
    return G, locations, edges, colors
```

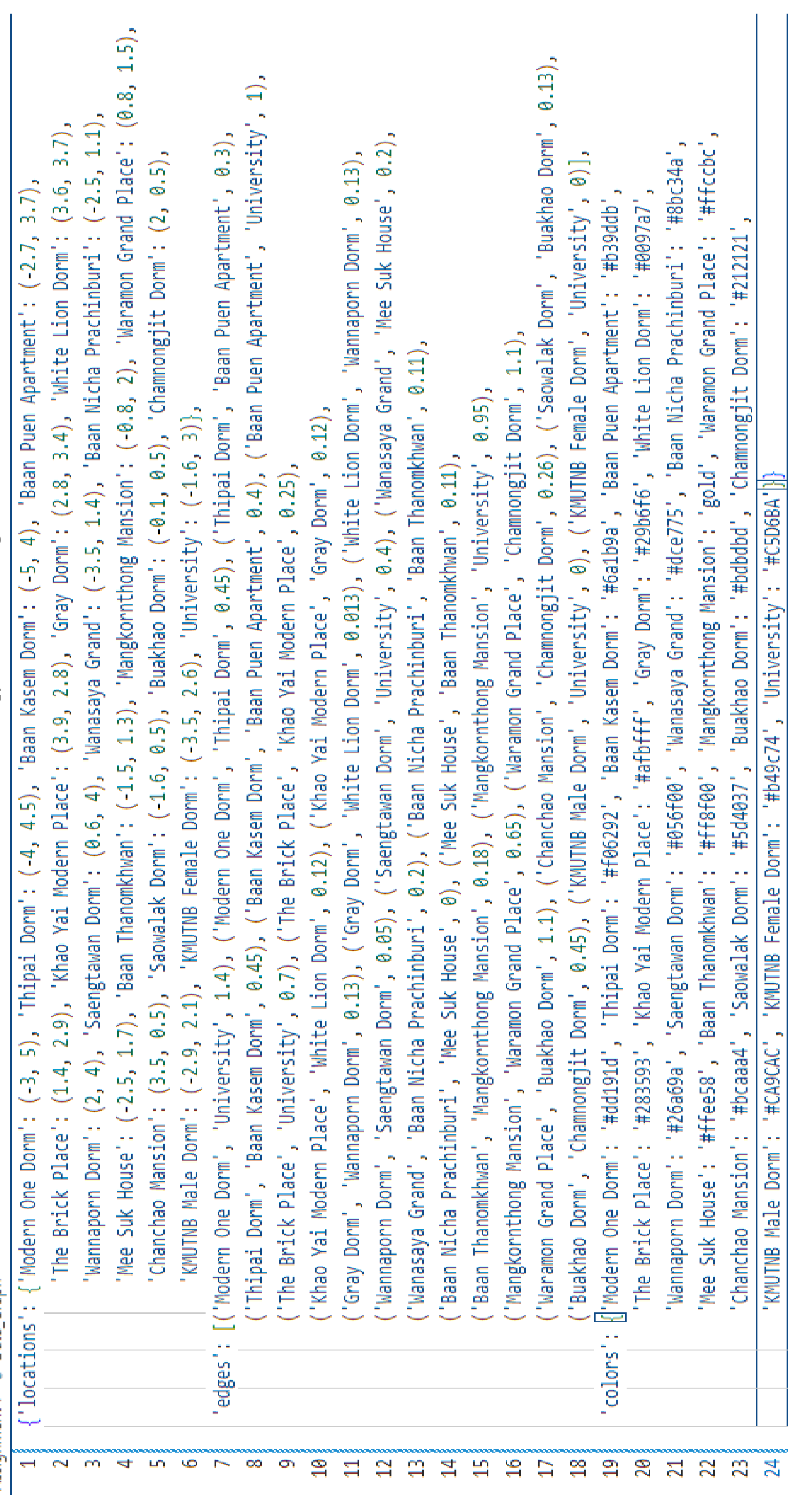


```python
if __name__ == "__main__":
    G, locations, colors = create_graph()

    while True:
        print("Shortest route search system\n1.Show Graph\n2.Find Shortest Path\n3.Insert Location\n4.Delete Location\n5.Save Graph\n0.Exit")
        choice = int(input("Enter your choice: "))
        if choice == 1:
            draw_graph(G, locations, colors)

        elif choice == 2:
            print("Available Locations:")
            for idx, loc in enumerate(locations.keys(), 1):
                print(f"{idx}. {loc}")

            location_start = int(input("Select location start: "))
            location_list = list(locations.keys())
            selected_location_start = location_list[location_start - 1]

            location_end = int(input("Select location end: "))
            selected_location_end = location_list[location_end - 1]

            if selected_location_start and selected_location_end in locations:
                path, distance = find_shortest_path(G, selected_location_start, selected_location_end)
                if path:
                    print(f"Shortest path to {selected_location_end}:")
                    print(" -> ".join(path))
                    print(f"Total distance: {format(distance,'.2f')} km")
                    draw_graph(G, locations,colors, path)
                else:
                    print("No path found.")
            else:
                print("Invalid location selection.")
```



```python
        elif choice == 3:
            name = input("Enter location name: ")
            color = input("Enter location color: ")
            pos = tuple(map(float, input("Enter location position (x, y): ").split(", ")))
            print("Available Locations:")
            for idx, loc in enumerate(locations.keys(), 1):
                print(f"{idx}. {loc}")

            location = int(input("Select location to insert distance : "))
            location_list = list(locations.keys())
            selected_location = location_list[location - 1]
            distance = float(input("Enter distance to selected location: "))
            insert_node(G, locations, name, pos, selected_location, distance, color)
            draw_graph(G, locations, colors)

        elif choice == 4:
            name = input("Enter location name to delete: ")
            delete_node(G, locations, name)
            draw_graph(G, locations, colors)

        elif choice == 5:
            save_graph(filename,G, locations, colors)

        elif choice == 0:
            break

        else:
            print("Invalid choice.")
            print("Please try again.")
        print()

    print("Thank you for using the system.")
```

Data เก็บข้อมูลใน Assign



```python
{'locations': {'Modern One Dorm': (-3, 5), 'Thipai Dorm': (-4, 4.5), 'Baan Kasem Dorm': (-5, 4), 'Baan Puen Apartment': (-2.7, 3.7),
    'The Brick Place': (1.4, 2.9), 'Khao Yai Modern Place': (3.9, 2.8), 'Gray Dorm': (2.8, 3.4), 'White Lion Dorm': (3.6, 3.7),
        'Wannaporn Dorm': (2, 4), 'Saengtawan Dorm': (0.6, 4), 'Wanasaya Grand': (-3.5, 1.4), 'Baan Nicha Prachinburi': (-2.5, 1.1),
        'Mee Suk House': (-2.5, 1.7), 'Baan Thanomkhwan': (-1.5, 1.3), 'Mangkornthong Mansion': (-0.8, 2), 'Waramon Grand Place': (0.8, 1.5),
        'Chanchao Mansion': (3.5, 0.5), 'Saowalak Dorm': (-1.6, 0.5), 'Buakhao Dorm': (-0.1, 0.5), 'Chamnongjit Dorm': (2, 0.5),
        'KMUTNB Male Dorm': (-2.9, 2.1), 'KMUTNB Female Dorm': (-3.5, 2.6), 'University': (-1.6, 3)},
'edges': [('Modern One Dorm', 'University', 1.4), ('Modern One Dorm', 'Thipai Dorm', 0.45), ('Thipai Dorm', 'Baan Puen Apartment', 0.3),
    ('Thipai Dorm', 'Baan Kasem Dorm', 0.45), ('Baan Kasem Dorm', 'Baan Puen Apartment', 0.4), ('Baan Puen Apartment', 'University', 1),
    ('The Brick Place', 'University', 0.7), ('The Brick Place', 'Khao Yai Modern Place', 0.25),
    ('Khao Yai Modern Place', 'White Lion Dorm', 0.12), ('Khao Yai Modern Place', 'Gray Dorm', 0.12),
    ('Gray Dorm', 'Wannaporn Dorm', 0.13), ('Gray Dorm', 'White Lion Dorm', 0.013), ('White Lion Dorm', 'Wannaporn Dorm', 0.13),
    ('Wannaporn Dorm', 'Saengtawan Dorm', 0.05), ('Saengtawan Dorm', 'University', 0.4), ('Wanasaya Grand', 'Mee Suk House', 0.2),
    ('Wanasaya Grand', 'Baan Nicha Prachinburi', 0.2), ('Baan Nicha Prachinburi', 'Baan Thanomkhwan', 0.11),
    ('Baan Nicha Prachinburi', 'Mee Suk House', 0), ('Mee Suk House', 'Baan Thanomkhwan', 0.11),
    ('Baan Thanomkhwan', 'Mangkornthong Mansion', 0.18), ('Mangkornthong Mansion', 'University', 0.95),
    ('Mangkornthong Mansion', 'Waramon Grand Place', 0.65), ('Waramon Grand Place', 'Chamnongjit Dorm', 1.1),
    ('Waramon Grand Place', 'Buakhao Dorm', 1.1), ('ChanChao Mansion', 'Chamnongjit Dorm', 0.26), ('Saowalak Dorm', 'Buakhao Dorm', 0.13),
    ('Buakhao Dorm', 'Chamnongjit Dorm', 0.45), ('KMUTNB Male Dorm', 'University', 0), ('KMUTNB Female Dorm', 'University', 0)],
'colors': {'Modern One Dorm': '#dd191d', 'Thipai Dorm': '#f06292', 'Baan Kasem Dorm': '#6a1b9a', 'Baan Puen Apartment': '#b39ddb',
    'The Brick Place': '#283593', 'Khao Yai Modern Place': '#afbfff', 'Gray Dorm': '#29b6f6', 'White Lion Dorm': '#0097a7',
    'Wannaporn Dorm': '#26a69a', 'Saengtawan Dorm': '#056f00', 'Wanasaya Grand': '#dce775', 'Baan Nicha Prachinburi': '#8bc34a',
    'Mee Suk House': '#ffee58', 'Baan Thanomkhwan': '#ff8f00', 'Mangkornthong Mansion': 'gold', 'Waramon Grand Place': '#ffccbc',
    'Chanchao Mansion': '#bcaaa4', 'Saowalak Dorm': '#5d4037', 'Buakhao Dorm': '#bdbdbd', 'Chamnongjit Dorm': '#212121',
    'KMUTNB Male Dorm': '#CA9CAC', 'KMUTNB Female Dorm': '#b49c74', 'University': '#C5D6BA'}}
```