

### TASK 3 – Abstract Data Type (ADT)

A linked list is an Abstract Data Type.

A linked list is used to store data in a linear structure.

### TASK 3.1

Discuss what a node and a pointer are in terms of a linked list.

## Why Linked Lists?

Linked lists and arrays are similar since they both store collections of data. The terminology is that arrays and linked lists store "elements" on behalf of "client" code. The specific type of element is not important since essentially the same structure works to store elements of any type. One way to think about linked lists is to look at how arrays work and think about alternate approaches.

## Array Review

Arrays are probably the most common data structure used to store collections of elements. In most languages, arrays are convenient to declare and they provide the handy `[]` syntax to access any element by its index number. The following example shows some typical array code and a drawing of how the array might look in memory. The code allocates an array `scores[100]` of `int`, sets the first three elements set to contain the numbers 1, 2, 3 and leaves the rest of the array uninitialized...

```

Procedure ArrayTest()
    DECLARE scores : ARRAY[1,100] OF INTEGER

    // operate on the elements of the scores array...
    scores[0] = 1
    scores[1] = 2
    scores[2] = 3

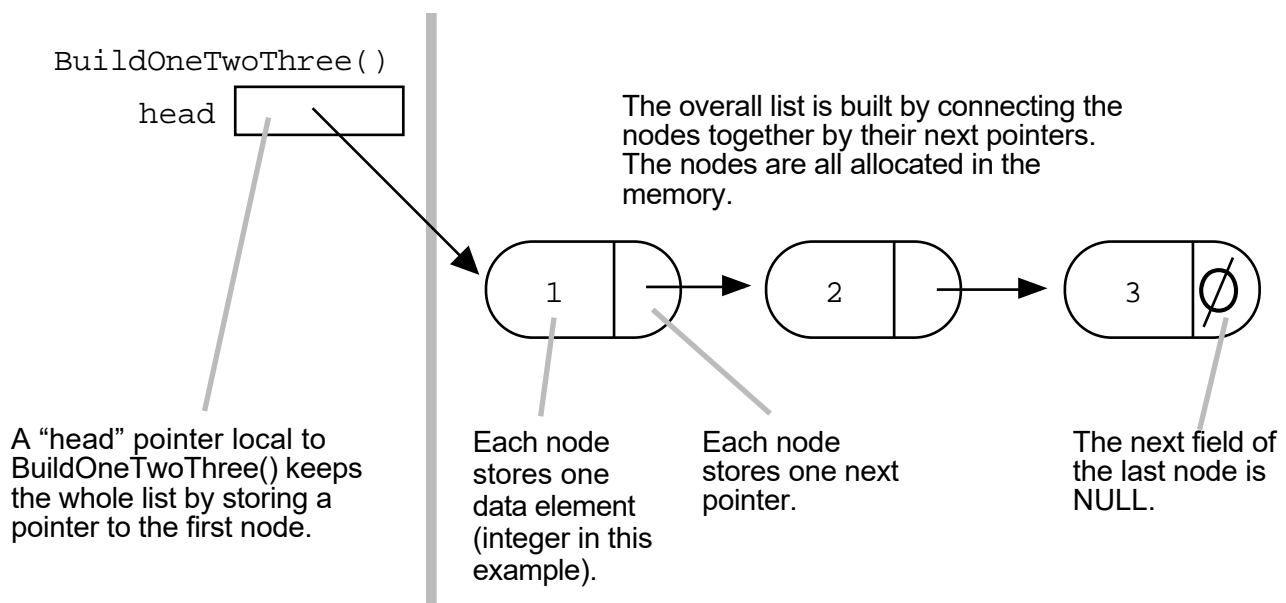
End Procedure

```

K \ Uh @ b \_ YX ' @ ghg ' @ cc \_ ' @ \_ Y

[illegible]

### The Drawing Of List {1, 2, 3}



### TASK 3.2

A company has a list of destinations that are visited as part of a round the world holiday.

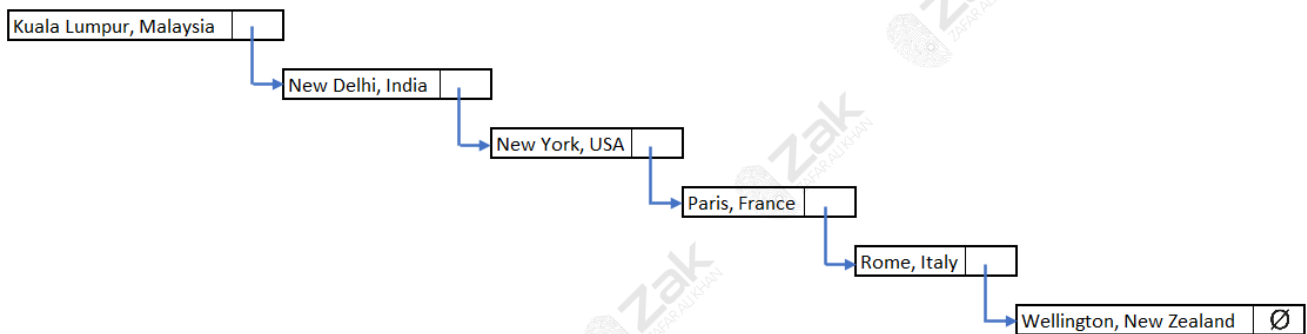
The destinations are:

- Paris, France
- Rome, Italy
- New Delhi, India
- Kuala Lumpur, Malaysia
- Wellington, New Zealand
- New York, USA

The destinations are stored in a linked list in the order shown.

Draw a diagram to represent the data as a linked list.

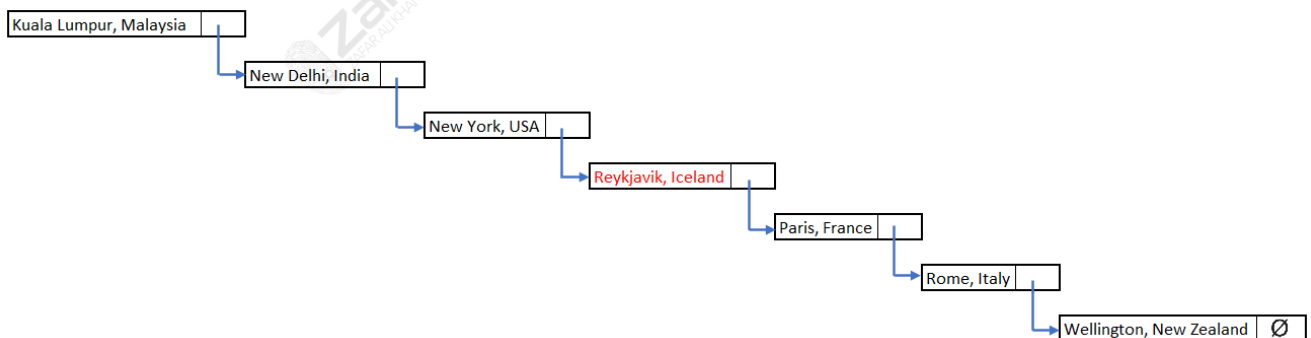
Use the symbol  $\emptyset$  to represent the null pointer.



### TASK 3.3

A further destination is added after New York; this destination is Reykjavik, Iceland.

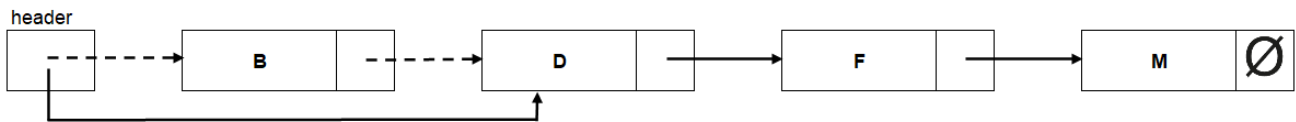
Add the new destination to the diagram of your linked list.



### TASK 3.4

Discuss how a node would be removed from the linked list.

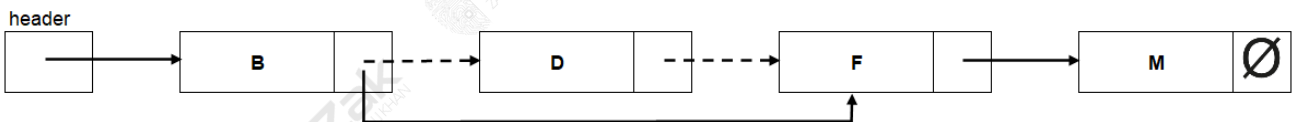
To delete the first node in the following linked list, we copy the pointer field of the node to be deleted into header. For the program code please observe the Python and VB.net code in respective GitHub folders.



To delete the last node in the following linked list, we set the pointer field for the previous node to the null pointer. For the program code please observe the Python and VB.net code in respective GitHub folders.



To delete the middle node in the following linked list, we set the pointer field for the previous node to the pointer of next node. For the program code please observe the Python and VB.net code in respective GitHub folders.



### TASK 3.5

Write **program code** to declare the linked list, using an array.

Please observe the Python and VB.net code in respective GitHub folders.

### TASK 3.6

Extend your **program code** by writing a subroutine that adds a new destination to the end of your linked list.

Please observe the Python and VB.net code in respective GitHub folders.

### TASK 3.7

Extend your **program code** by writing a subroutine to delete the destination node entered by the user from the linked list.

Please observe the Python and VB.net code in respective GitHub folders.

### TASK 3.8

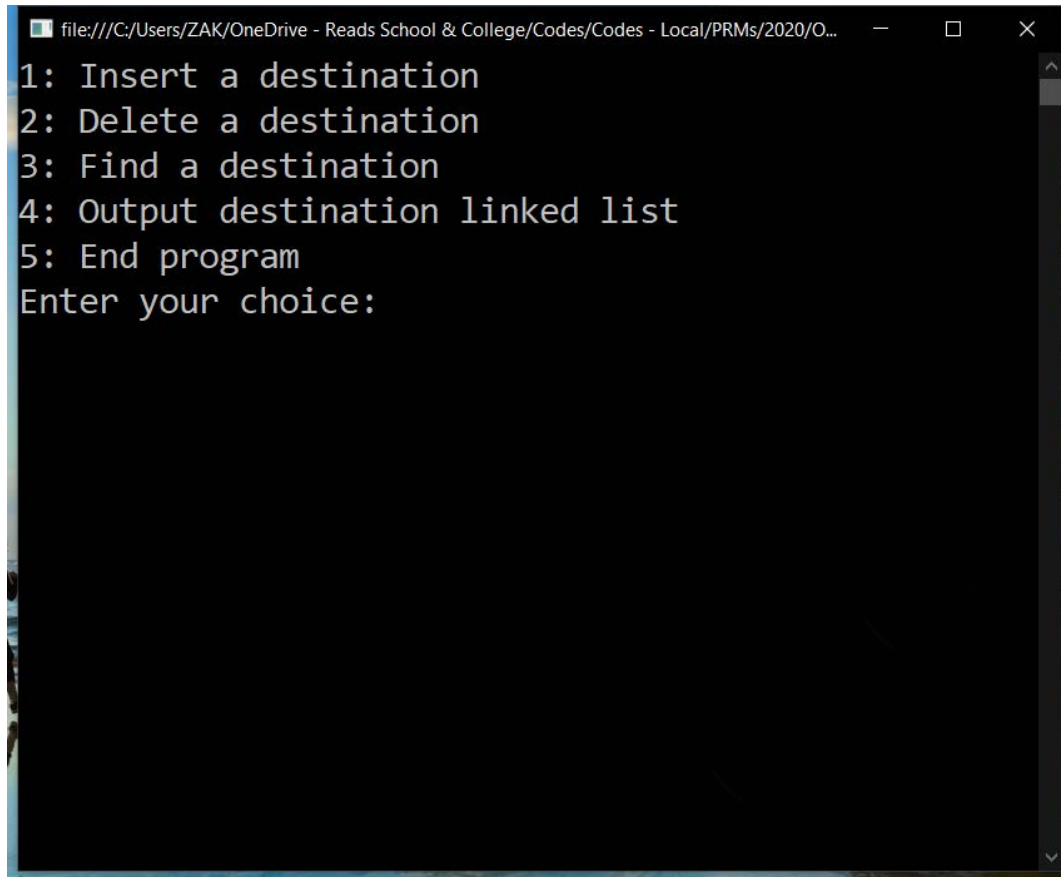
Discuss other linked list operations that could be implemented.

Write **program code** to implement the operation(s) you discuss.

Other linked list operations could be:

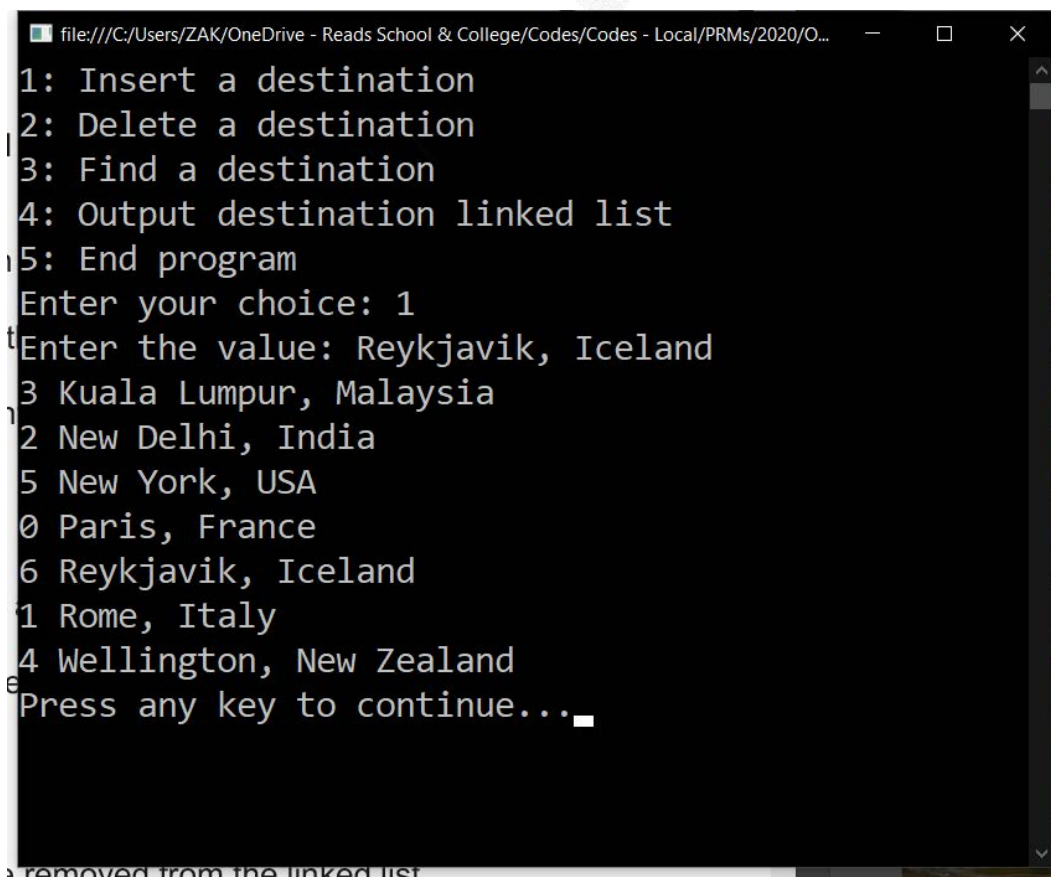
- a. Insert a node
- b. Delete a node
- c. Find/search a node
- d. Read all nodes

Please observe the Python and VB.net code in respective GitHub folders.

**Program Simulator (Screen Shots):**

A screenshot of a terminal window with a black background and white text. The window title bar shows the file path: file:///C:/Users/ZAK/OneDrive - Reads School & College/Codes/Codes - Local/PRMs/2020/O... The text in the terminal lists five menu options: 1: Insert a destination, 2: Delete a destination, 3: Find a destination, 4: Output destination linked list, and 5: End program. Below the list, it prompts the user to 'Enter your choice:'. The terminal has a vertical scrollbar on the right side.

```
file:///C:/Users/ZAK/OneDrive - Reads School & College/Codes/Codes - Local/PRMs/2020/O...
1: Insert a destination
2: Delete a destination
3: Find a destination
4: Output destination linked list
5: End program
Enter your choice:
```



A screenshot of a terminal window showing the same menu as the first image. The user has entered '1' for the first option. The terminal then prompts for a value, and the user has entered 'Reykjavik, Iceland'. Below this, a list of destinations is displayed: 3 Kuala Lumpur, Malaysia; 2 New Delhi, India; 5 New York, USA; 0 Paris, France; 6 Reykjavik, Iceland; 1 Rome, Italy; 4 Wellington, New Zealand. The terminal prompts the user to 'Press any key to continue...'. The terminal has a vertical scrollbar on the right side.

```
file:///C:/Users/ZAK/OneDrive - Reads School & College/Codes/Codes - Local/PRMs/2020/O...
1: Insert a destination
2: Delete a destination
3: Find a destination
4: Output destination linked list
5: End program
Enter your choice: 1
Enter the value: Reykjavik, Iceland
3 Kuala Lumpur, Malaysia
2 New Delhi, India
5 New York, USA
0 Paris, France
6 Reykjavik, Iceland
1 Rome, Italy
4 Wellington, New Zealand
Press any key to continue...
```

```
file:///C:/Users/ZAK/OneDrive - Reads School & College/Codes/Codes - Local/PRMs/2020/O...
1: Insert a destination
2: Delete a destination
3: Find a destination
4: Output destination linked list
5: End program
Enter your choice: 2
Enter the value: Reykjavik, Iceland
3 Kuala Lumpur, Malaysia
2 New Delhi, India
5 New York, USA
0 Paris, France
1 Rome, Italy
4 Wellington, New Zealand
Press any key to continue...
```

```
file:///C:/Users/ZAK/OneDrive - Reads School & College/Codes/Codes - Local/PRMs/2020/O...
1: Insert a destination
2: Delete a destination
3: Find a destination
4: Output destination linked list
5: End program
Enter your choice: 4
3 Kuala Lumpur, Malaysia
2 New Delhi, India
5 New York, USA
0 Paris, France
1 Rome, Italy
4 Wellington, New Zealand
Press any key to continue...
```

```
file:///C:/Users/ZAK/OneDrive - Reads School & College/Codes/Codes - Local/PRMs/2020/O...
1: Insert a destination
2: Delete a destination
3: Find a destination
4: Output destination linked list
5: End program
Enter your choice: 3
Enter the destination: Karachi, Pakistan
Destination not found
Press any key to continue...
```

```
file:///C:/Users/ZAK/OneDrive - Reads School & College/Codes/Codes - Local/PRMs/2020/O...
1: Insert a destination
2: Delete a destination
3: Find a destination
4: Output destination linked list
5: End program
Enter your choice: 1
Enter the destination: Dubai, UAE
no space for more Destination
Press any key to continue...
```

```
file:///C:/Users/ZAK/OneDrive - Reads School & College/Codes/Codes - Local/PRMs/2020/O...
1: Insert a destination
2: Delete a destination
3: Find a destination
4: Output destination linked list
5: End program
Enter your choice: 3
Enter the destination: Reykjavik, Iceland
Destination found...
6 Reykjavik, Iceland
Press any key to continue...
```

```
file:///C:/Users/ZAK/OneDrive - Reads School & College/Codes/Codes - Local/PRMs/2020/O...
1: Insert a destination
2: Delete a destination
3: Find a destination
4: Output destination linked list
5: End program
Enter your choice: 3
Enter the destination: Hyderabad
Destination not found
Press any key to continue...
```