**BAHRIA UNIVERSITY (KARACHI CAMPUS**)

**Data Structures & Algorithms (CSC- 221)**

**Assignment 01**

**Fall 2023**

**Class: BSE 3B Shift: Morning**

**Course Instructor: Engr. Laraib Siddiqui Due Date: 03 Nov 2023**

**Assignment Date: 30 Oct 2023 Marks: 06 Points**

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Question No 01:

Consider the following postfix expressions:

1. 5, 3, +, 2, \*, 6, 9, 7, - , /, -
2. 3, 1, +, 2, ^, 7, 4, -, 2, \*, +, 5, -

Solve each postfix expression into equivalent prefix expression.

Answer:

1. **5,3, +, 2, \*, 6, 9, 7, -, /,-**

Stack Prefix

+,5,3

Expression

2,\*,6,9,7,-,/,-

Stack Prefix

\*,+,5,3,2

Expression

6,9,7,-,/,-

Stack Prefix

\*,+,5,3,2,6,-,9,7

Expression

/,-

Stack Prefix

\*,+,5,3,2,/,6,-,9,7

Expression

\_

Stack Prefix

-,\*,+,5,3,2,/,6,-,9,7 **Answer**

1. **3,1, +, 2, ^, 7,4, -, 2, \*,+,5, -**

Stack Prefix

+,3,1

Expression

2,^,7,4,-,2,\*,+,5,-

Stack Prefix

^,+,3,1,2

Expression

7,4,-,2,\*,+,5,-

Stack Prefix

^,+,3,1,2,-,7,4

Expression

2,\*,+,5,-

Stack Prefix

^,+,3,1,2,\*,-,7,4,2

Expression

+,5,-

Stack Prefix

+,^,+,3,1,2,\*,-,7,4,2,5

Expression

-

Stack Prefix

-,+,^,+,3,1,2,\*,-,7,4,2,5 **Answer**

Question N0 02:

Consider the alphabetical linear array NAME:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Ali | Annie | Bilal | Danial | Eman | Gohar | Haris | Ibad | Laiba | Moiz | Ryan | Saad | Warda | Zaib |

Use the following search algorithms to determine how many comparisons are used to locate Gohar, Moiz & Saad:

1. Linear Search.
2. Binary Search.

Answer:

1. **Linear search:**
2. Locating Gohar, Target = Gohar

1st comparison: arr[0] == target (target not found)

2nd comparison: arr[1] == target (target not found)

3rd comparison: arr[2] == target (target not found)

4th comparison: arr[3] == target (target not found)

5th comparison: arr[4] == target (target not found)

6th comparison: arr[5] == target (**target found**)

Total comparisons to locate ‘Gohar’: 6

1. Locating Moiz, Target =Moiz

1st comparison: arr[0] == target (target not found)

2nd comparison: arr[1] == target (target not found)

3rd comparison: arr[2] == target (target not found)

4th comparison: arr[3] == target (target not found)

5th comparison: arr[4] == target (target not found)

6th comparison: arr[5] == target (target not found)

7th comparison: arr[6] == target (target not found)

8th comparison: arr[7] == target (target not found)

9th comparison: arr[8] == target (target not found)

10th comparison: arr[9] == target (**target found**)

Total comparisons to locate ‘Moiz’: 10

1. Locating Saad, Target = Saad

1st comparison: arr[0] == target (target not found)

2nd comparison: arr[1] == target (target not found)

3rd comparison: arr[2] == target (target not found)

4th comparison: arr[3] == target (target not found)

5th comparison: arr[4] == target (target not found)

6th comparison: arr[5] == target (target not found)

7th comparison: arr[6] == target (target not found)

8th comparison: arr[7] == target (target not found)

9th comparison: arr[8] == target (target not found)

10th comparison: arr[9] == target (target not found)

11th comparison: arr[10] == target (target not found)

12th comparison: arr[11] == target (**target found**)

Total comparisons to locate ‘Saad’: 12

1. Binary Search.
2. **Gohar:**

First Last

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Ali | Annie | Bilal | Danial | Eman | Gohar | Haris | Ibad | Laiba | Moiz | Ryan | Saad | Warda | Zaib |

**1st Step)**

Mid = First + Last

2

Mid = 0 + 13

2

Mid = 6.5 = 6

Target < 6

Last = 5

First Last

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 |
| Ali | Annie | Bilal | Danial | Eman | Gohar |

**2nd Step)**

Mid = First + Last

2

Mid = 0 + 5

2

Mid = 2.5 = 2

Target > 2

First = 3

First Last

|  |  |  |
| --- | --- | --- |
| 3 | 4 | 5 |
| Danial | Eman | Gohar |

**3rd Step)**

Mid = First + Last

2

Mid = 3 + 5

2

Mid = 4 = 4

Target > 4

First = 5

First Mid Last

|  |
| --- |
| 5 |
| Gohar |

**4th Step)**

Target Found

Total comparisons to Locate Gohar 4

1. **Moiz**

First Last

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Ali | Annie | Bilal | Danial | Eman | Gohar | Haris | Ibad | Laiba | Moiz | Ryan | Saad | Warda | Zaib |

**1st Step)**

Mid = First + Last

2

Mid = 0 + 13

2

Mid = 6.5 = 6

Target > 6

First = 7

First Last

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Ibad | Laiba | Moiz | Ryan | Saad | Warda | Zaib |

**2nd Step)**

Mid = First + Last

2

Mid = 7 + 13

2

Mid = 10

Target < 10

Last = 9

First Last

|  |  |  |
| --- | --- | --- |
| 7 | 8 | 9 |
| Ibad | Laiba | Moiz |

**3rd Step)**

Mid = First + Last

2

Mid = 7 + 9

2

Mid = 8

Target > 8

First = 9

First Mid Last

|  |
| --- |
| 9 |
| Moiz |

**4th Step)**

Target Found

Total comparisons to Locate Moiz 4

1. **Saad**

First Last

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Ali | Annie | Bilal | Danial | Eman | Gohar | Haris | Ibad | Laiba | Moiz | Ryan | Saad | Warda | Zaib |

**1st Step)**

Mid = First + Last

2

Mid = 0 + 13

2

Mid = 6.5 = 6

Target > 6

First = 7

First Last

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Ibad | Laiba | Moiz | Ryan | Saad | Warda | Zaib |

**2nd Step)**

Mid = First + Last

2

Mid = 7 + 13

2

Mid = 10

Target > 10

First = 11

First Last

|  |  |  |
| --- | --- | --- |
| 11 | 12 | 13 |
| Saad | Warda | Zaib |

**3rd Step)**

Mid = First + Last

2

Mid = 11 + 13

2

Mid = 12

Target < 12

First = 11

First Mid Last

|  |
| --- |
| 11 |
| Saad |

**4th Step)**

Target Found

Total comparisons to Locate Saad 4