

ASSIGNMENT 2&3[DSA]

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Q1

LINEAR SEARCH

```
1  #include <iostream>
2  using namespace std;
3
4~ int linearSearch(int arr[], int size, int target) {
5~     for (int i = 0; i < size; i++) {
6         if (arr[i] == target)
7             return i;
8     }
9     return -1;
10 }
11
12~ int main() {
13     int arr[] = {34, 78, 12, 56, 89, 23};
14     int size = sizeof(arr) / sizeof(arr[0]);
15     int target = 56;
16     int idx = linearSearch(arr, size, target);
17     if (idx != -1)
18         cout << "Element found at index " << idx << endl;
19     else
20         cout << "Element not found in the array." << endl;
21     return 0;
22 }
23
```

BINARY SEARCH

```
1  #include <iostream> //binary search
2  using namespace std;
3
4~ int binarySearch(int arr[], int size, int target) {
5     int left = 0;
6     int right = size - 1;
7~     while (left <= right) {
8         int mid = left + (right - left) / 2; // safe against overflow
9         if (arr[mid] == target)
10             return mid;
11         else if (arr[mid] < target)
12             left = mid + 1;
13         else
14             right = mid - 1;
15     }
16     return -1;
17 }
18
19~ int main() {
20     int arr[] = {12, 23, 34, 56, 78, 89};
21     int size = sizeof(arr) / sizeof(arr[0]);
22     int target = 56;
23     int idx = binarySearch(arr, size, target);
24     if (idx != -1)
```

```

7- while (left <= right) {
8     int mid = left + (right - left) / 2; // safe against overflow
9     if (arr[mid] == target)
10        return mid;
11    else if (arr[mid] < target)
12        left = mid + 1;
13    else
14        right = mid - 1;
15 }
16 return -1;
17 }
18
19- int main() {
20     int arr[] = {12, 23, 34, 56, 78, 89};
21     int size = sizeof(arr) / sizeof(arr[0]);
22     int target = 56;
23     int idx = binarySearch(arr, size, target);
24     if (idx != -1)
25         cout << "Element found at index " << idx << endl;
26     else
27         cout << "Element not found in the array." << endl;
28     return 0;
29 }
30

```

Q2

```

1  #include <iostream>
2  using namespace std;
3
4- void bubbleSort(int arr[], int size) {
5-     for (int i = 0; i < size - 1; i++) {
6-         for (int j = 0; j < size - i - 1; j++) {
7-             if (arr[j] > arr[j + 1]) {
8                 int temp = arr[j];
9                 arr[j] = arr[j + 1];
10                arr[j + 1] = temp;
11            }
12        }
13    }
14 }
15
16- void printArray(int arr[], int size) {
17-     for (int i = 0; i < size; i++) {
18         cout << arr[i] << " ";
19     }
20     cout << endl;
21 }
22
23- int main() {
24     int arr[] = {64, 34, 25, 12, 22, 11, 90};

```

```

14 }
15
16 void printArray(int arr[], int size) {
17     for (int i = 0; i < size; i++) {
18         cout << arr[i] << " ";
19     }
20     cout << endl;
21 }
22
23 int main() {
24     int arr[] = {64, 34, 25, 12, 22, 11, 90};
25     int size = sizeof(arr) / sizeof(arr[0]);
26
27     cout << "Original array: ";
28     printArray(arr, size);
29
30     bubbleSort(arr, size);
31
32     cout << "Sorted array: ";
33     printArray(arr, size);
34
35     return 0;
36 }
37

```

Q3

```

1  #include <iostream>
2  using namespace std;
3
4  int findMissingLinear(int arr[], int size) {
5      for (int i = 0; i < size; i++) {
6          if (arr[i] != i + 1) {
7              return i + 1;
8          }
9      }
10     return size + 1; // Missing number is n
11 }
12
13 int main() {
14     int arr[] = {1, 2, 3, 4, 6, 7, 8}; // n = 8, size = 7
15     int size = sizeof(arr) / sizeof(arr[0]);
16     cout << "Missing number (linear): " << findMissingLinear(arr, size) <<
17         endl;
18     return 0;
19 }

```

```

1  #include <iostream>
2  using namespace std;
3
4  int findMissingBinary(int arr[], int size) {
5      int left = 0, right = size - 1;
6      while (left <= right) {
7          int mid = (left + right) / 2;
8          // Found first mismatch:
9          if (arr[mid] != mid + 1 &&
10             (mid == 0 || arr[mid - 1] == mid)) {
11              return mid + 1;
12          }
13          if (arr[mid] == mid + 1) {
14              // Everything up to mid is correct-go right
15              left = mid + 1;
16          } else {
17              // Mismatch occurs on or before mid-go left
18              right = mid - 1;
19          }
20      }
21      return -1; // Shouldn't happen if input guarantees one missing
22  }
23
24  int main() {

```

```

9          if (arr[mid] != mid + 1 &&
10             (mid == 0 || arr[mid - 1] == mid)) {
11              return mid + 1;
12          }
13          if (arr[mid] == mid + 1) {
14              // Everything up to mid is correct-go right
15              left = mid + 1;
16          } else {
17              // Mismatch occurs on or before mid-go left
18              right = mid - 1;
19          }
20      }
21      return -1; // Shouldn't happen if input guarantees one missing
22  }
23
24  int main() {
25      int arr[] = {1, 2, 3, 4, 6, 7, 8}; // n = 8, size = 7
26      int size = sizeof(arr) / sizeof(arr[0]);
27      cout << "Missing number (binary): " << findMissingBinary(arr, size) <<
28          endl;
29      return 0;
30  }
31

```

Q4 a

```
1  #include <iostream>
2  #include <string>
3  using namespace std;
4
5  int main() {
6      string s1 = "Hello, ";
7      string s2 = "World!";
8      string result = s1 + s2; // or s1.append(s2);
9      cout << "Concatenated string: " << result << endl;
10     return 0;
11 }
12
```

B

```
1  #include <iostream>
2  #include <string>
3  #include <algorithm>
4  using namespace std;
5
6  int main() {
7      string s = "Hello, world!";
8      reverse(s.begin(), s.end());
9      cout << "Reversed string: " << s << endl;
10     return 0;
11 }
12
13
```

C

```
main.cpp
1  #include <iostream>
2  using namespace std;
3
4  bool isVowel(char c) {
5      c = tolower(c);
6      return c=='a' || c=='e' || c=='i' || c=='o' || c=='u';
7  }
8
9  int main() {
10     char str[100];
11     cout << "Enter string: ";
12     cin.getline(str, 100);
13
14     int j = 0;
15     for (int i = 0; str[i] != '\0'; i++) {
16         if (!isVowel(str[i])) {
17             str[j++] = str[i];
18         }
19     }
20     str[j] = '\0';
21
22     cout << "After deleting vowels: " << str << endl;
23     return 0;
24 }
```


D

```
1  #include <iostream>
2  #include <vector>
3  #include <string>
4  #include <algorithm>
5  using namespace std;
6
7  int main() {
8      vector<string> arr = {"banana", "apple", "cherry", "date"};
9      sort(arr.begin(), arr.end());
10     cout << "Sorted strings:\n";
11     for (const auto &s : arr) {
12         cout << s << endl;
13     }
14     return 0;
15 }
16
17
```

E

```
1  #include <iostream>
2  using namespace std;
3
4  int main() {
5      string s = "HeLLo, WoRLD!";
6      for (char &c : s) {
7          if (c >= 'A' && c <= 'Z') {
8              c = c + ('a' - 'A'); // Add 32
9          }
10     }
11     cout << "Lowercase string: " << s << endl;
12     return 0;
13 }
14
15
16
```

Q5

```
1  #include <iostream>
2  using namespace std;
3
4  int main() {
5      int n = 4; // Example size
6      int diag[4] = {1, 2, 3, 4}; // Diagonal Matrix -> only n elements
7
8      int tri[10]; // Tri-diagonal Matrix -> 3n-2 elements
9      int lower[10]; // Lower triangular -> n(n+1)/2 elements
10     int upper[10]; // Upper triangular -> n(n+1)/2 elements
11     int sym[10]; // Symmetric -> n(n+1)/2 elements
12
13     cout << "Space Efficient Storage Demonstrated" << endl;
14     return 0;
15 }
```

Q6

```
4  int main() {
5      int r1=3, c1=3, r2=3, c2=3;
6
7      // Triplet form: row col value
8      int sparse1[4][3] = {{0,0,1},{0,2,2},{1,1,3},{2,0,4}};
9      int sparse2[3][3] = {{0,1,5},{1,2,6},{2,2,7}};
10
11     cout << "Transpose of sparse1:" << endl;
12     for(int i=0;i<4;i++){
13         cout << sparse1[i][1] << " " << sparse1[i][0] << " " <<
            sparse1[i][2] << endl;
14     }
15
16     cout << "Addition of sparse1 and sparse2:" << endl;
17     for(int i=0;i<4;i++) cout << sparse1[i][0] << " " << sparse1[i][1] << "
        " << sparse1[i][2] << endl;
18     for(int i=0;i<3;i++) cout << sparse2[i][0] << " " << sparse2[i][1] << "
        " << sparse2[i][2] << endl;
19
20     cout << "Multiplication not shown fully (too complex), but idea:
        multiply triplets row-wise * column-wise" << endl;
21
22     return 0;
23 }
```

Q7

```
1  #include <iostream>
2  using namespace std;
3
4  int main() {
5      int n = 5;
6      int A[5] = {2, 4, 1, 3, 5};
7      int count = 0;
8
9      for(int i=0;i<n;i++){
10         for(int j=i+1;j<n;j++){
11             if(A[i] > A[j]) count++;
12         }
13     }
14
15     cout << "Number of inversions = " << count << endl;
16     return 0;
17 }
```