

C q1.c **X** **C q2.c** **C q3.c** **C q4.c**

```
Week3 > C q1.c
 1 #include <mpi.h>
 2 #include <stdio.h>
 3
 4 long long factorial(int n) {
 5     long long fact = 1;
 6     for (int i = 1; i <= n; i++)
 7         fact *= i;
 8     return fact;
 9 }
10
11 int main(int argc, char *argv[]) {
12     int rank, size;
13     int number;
14     long long fact, sum = 0;
15     int values[100];
16     long long facts[100];
17
18     MPI_Init(&argc, &argv);
19     MPI_Comm_rank(MPI_COMM_WORLD, &rank);
20     MPI_Comm_size(MPI_COMM_WORLD, &size);
21
22     if (rank == 0) {
23         printf("Enter the numbers: \n");
24         for (int i = 0; i < size; i++) {
25             scanf("%d", &values[i]);
26         }
27     }
28
29     MPI_Scatter(values, 1, MPI_INT,
30                 &number, 1, MPI_INT,
31                 0, MPI_COMM_WORLD);
32
33     fact = factorial(number);
34
35     MPI_Gather(&fact, 1, MPI_LONG_LONG_INT,
36                facts, 1, MPI_LONG_LONG_INT,
37                0, MPI_COMM_WORLD);
38
39     if (rank == 0) {
40         for (int i = 0; i < size; i++) {
41             sum += facts[i];
42         }
43         printf("Total: %lld\n", sum);
44         printf("Q1, Adarsh Ranjan 230962278\n");
45     }
46
47     MPI_Finalize();
48     return 0;
49 }
50
```

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● (base) mca@computinglab25-22:~/Desktop/PPL_230962278/Week3$ mpicc ql.c -o ql
● (base) mca@computinglab25-22:~/Desktop/PPL_230962278/Week3$ mpirun -np 4 ./ql
hwloc/linux: Ignoring PCI device with non-16bit domain.
Pass --enable-32bits-pci-domain to configure to support such devices
(warning: it would break the library ABI, don't enable unless really needed).
Enter the numbers:
1
2
3
4
Total: 33
Q1, Adarsh Ranjan 230962278
```

Week3 > C q2.c

```
1 #include <mpi.h>
2 #include <stdio.h>
3
4 int main(int argc, char *argv[]) {
5     int rank, size, M;
6     int id[10000];
7     int recv[10000];
8     double local_avg, total_avg;
9     double avg[1000];
10
11    MPI_Init(&argc, &argv);
12    MPI_Comm_rank(MPI_COMM_WORLD, &rank);
13    MPI_Comm_size(MPI_COMM_WORLD, &size);
14
15    if (rank == 0) {
16        printf("Enter the Integer M:\n");
17        scanf("%d", &M);
18
19        printf("Enter %d elements:\n", M * size);
20        for (int i = 0; i < M * size; i++) {
21            scanf("%d", &id[i]);
22        }
23    }
24
25    MPI_Bcast(&M, 1, MPI_INT, 0, MPI_COMM_WORLD);
26
27    MPI_Scatter(id, M, MPI_INT,
28                recv, M, MPI_INT,
29                0, MPI_COMM_WORLD);
30
31    int sum = 0;
32    for (int i = 0; i < M; i++) {
33        sum += recv[i];
34    }
35
36    local_avg = (double)sum / M;
37
38    MPI_Gather(&local_avg, 1, MPI_DOUBLE,
39                avg, 1, MPI_DOUBLE,
40                0, MPI_COMM_WORLD);
41
42    if (rank == 0) {
43        double total = 0.0;
44        for (int i = 0; i < size; i++) {
45            total += avg[i];
46        }
47        total_avg = total / size;
48        printf("Total Average = %lf\n", total_avg);
49        printf("Q2, Adarsh Ranjan 230962278\n");
50    }
51
52    MPI_Finalize();
53    return 0;
54}
```

```
Q1, Adarsh Ranjan 230962278
● (base) mca@computinglab25-22:~/Desktop/PPL_230962278/Week3$ mpicc q2.c -o q2
● (base) mca@computinglab25-22:~/Desktop/PPL_230962278/Week3$ mpirun -np 2 ./q2
hwloc/linux: Ignoring PCI device with non-16bit domain.
Pass --enable-32bits-pci-domain to configure to support such devices
(warning: it would break the library ABI, don't enable unless really needed).
Enter the Integer M:
2
Enter 4 elements:
1
2
3
4
Total Average = 2.500000
Q2, Adarsh Ranjan 230962278
```

C q1.c	C q2.c	C q3.c	X	C q4.c
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Week3 > C q3.c

```
1 #include <mpi.h>
2 #include <stdio.h>
3 #include <stdlib.h>
4 #include <string.h>
5 #include <ctype.h>
6
7 int is_vowel(char c)
8 {
9     c = tolower(c);
10    return (c=='a'||c=='e'||c=='i'||c=='o'||c=='u');
11 }
12
13 int main(int argc, char *argv[])
14 {
15     int rank, size;
16     char *str = NULL;
17     char *local_str;
18     int n, local_n;
19     int local_count = 0;
20     int *counts = NULL;
21     int total = 0;
22
23     MPI_Init(&argc, &argv);
24     MPI_Comm_rank(MPI_COMM_WORLD, &rank);
25     MPI_Comm_size(MPI_COMM_WORLD, &size);
26
27     if (rank == 0)
28     {
29         str = (char *)malloc(1024 * sizeof(char));
30         printf("Enter the string: ");
31         fflush(stdout);
32         fgets(str, 1024, stdin);
33         str[strcspn(str, "\n")] = '\0';
34         n = strlen(str);
35     }
36
37     MPI_Bcast(&n, 1, MPI_INT, 0, MPI_COMM_WORLD);
38
39     if (n % size != 0)
40     {
41         if (rank == 0)
42             printf("Error: String length must be evenly divisible by number of processes\n");
43         MPI_Finalize();
44         return 0;
45     }
46
47     local_n = n / size;
48     local_str = (char *)malloc(local_n * sizeof(char));
49
50     MPI_Scatter(str, local_n, MPI_CHAR, local_str, local_n, MPI_CHAR, 0, MPI_COMM_WORLD);
51
52     for (int i = 0; i < local_n; i++)
53     {
54         if (!is_vowel(local_str[i]))
55             local_count++;
56     }
57
58     if (rank == 0)
59         counts = (int *)malloc(size * sizeof(int));
60
61     MPI_Gather(&local_count, 1, MPI_INT, counts, 1, MPI_INT, 0, MPI_COMM_WORLD);
62     MPI_Reduce(&local_count, &total, 1, MPI_INT, MPI_SUM, 0, MPI_COMM_WORLD);
63
64     if (rank == 0)
65     {
66         for (int i = 0; i < size; i++)
67             printf("Process %d: %d\n", i, counts[i]);
68         printf("Total non-vowels: %d\n", total);
69         printf("Q3, Adarsh Ranjan 230962278\n");
70     }
71
72     MPI_Finalize();
73     return 0;
74 }
```

```
● (base) mca@computinglab25-22:~/Desktop/PPL_230962278/Week3$ mpicc q3.c -o q3
● (base) mca@computinglab25-22:~/Desktop/PPL_230962278/Week3$ mpirun -np 3 ./q3
hwloc/linux: Ignoring PCI device with non-16bit domain.
Pass --enable-32bits-pci-domain to configure to support such devices
(warning: it would break the library ABI, don't enable unless really needed).
Enter the string: adarsh
Process 0: 1
Process 1: 1
Process 2: 2
Total non-vowels: 4
Q3, Adarsh Ranjan 230962278
```

C q1.c	C q2.c	C q3.c	C q4.c	X
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```

Week3 > C q4.c
1  #include <mpi.h>
2  #include <stdio.h>
3  #include <string.h>
4  #include <stdlib.h>
5
6  int main(int argc, char** argv) {
7      int rank, size;
8      char s1[100], s2[100];
9      char *res = NULL;
10     char *sub_s1, *sub_s2, *sub_res;
11     int n, m;
12
13     MPI_Init(&argc, &argv);
14     MPI_Comm_rank(MPI_COMM_WORLD, &rank);
15     MPI_Comm_size(MPI_COMM_WORLD, &size);
16
17     if (rank == 0) {
18         printf("Enter String 1: ");
19         fflush(stdout);
20         scanf("%s", s1);
21         printf("Enter String 2: ");
22         fflush(stdout);
23         scanf("%s", s2);
24
25         n = strlen(s1);
26
27         if (n % size != 0) {
28             fflush(stdout);
29             MPI_Abort(MPI_COMM_WORLD, 1);
30         }
31
32         m = n / size;
33     }
34
35     MPI_Bcast(&m, 1, MPI_INT, 0, MPI_COMM_WORLD);
36     MPI_Bcast(&n, 1, MPI_INT, 0, MPI_COMM_WORLD);
37
38     sub_s1 = (char*)malloc(m * sizeof(char));
39     sub_s2 = (char*)malloc(m * sizeof(char));
40     sub_res = (char*)malloc(2 * m * sizeof(char));
41
42     MPI_Scatter(s1, m, MPI_CHAR, sub_s1, m, MPI_CHAR, 0, MPI_COMM_WORLD);
43     MPI_Scatter(s2, m, MPI_CHAR, sub_s2, m, MPI_CHAR, 0, MPI_COMM_WORLD);
44
45     for (int i = 0; i < m; i++) {
46         sub_res[2 * i] = sub_s1[i];
47         sub_res[2 * i + 1] = sub_s2[i];
48     }
49
50     if (rank == 0) {
51         res = (char*)malloc((2 * n + 1) * sizeof(char));
52     }
53
54     MPI_Gather(sub_res, 2 * m, MPI_CHAR, res, 2 * m, MPI_CHAR, 0, MPI_COMM_WORLD);
55
56     if (rank == 0) {
57         res[2 * n] = '\0';
58         printf("\nResult: %s\n", res);
59         printf("Q4, Adarsh Ranjan 230962278\n");
60
61         free(res);
62     }
63
64     free(sub_s1);
65     free(sub_s2);
66     free(sub_res);
67
68     MPI_Finalize();
69     return 0;
70 }

```

```
● (base) mca@computinglab25-22:~/Desktop/PPL_230962278/Week3$ mpicc q4.c -o q4
● (base) mca@computinglab25-22:~/Desktop/PPL_230962278/Week3$ mpirun -np 3 ./q4
hwloc/linux: Ignoring PCI device with non-16bit domain.
Pass --enable-32bits-pci-domain to configure to support such devices
(warning: it would break the library ABI, don't enable unless really needed).
Enter String 1: string
Enter String 2: length

Result: slternightgh
Q4, Adarsh Ranjan 230962278
```