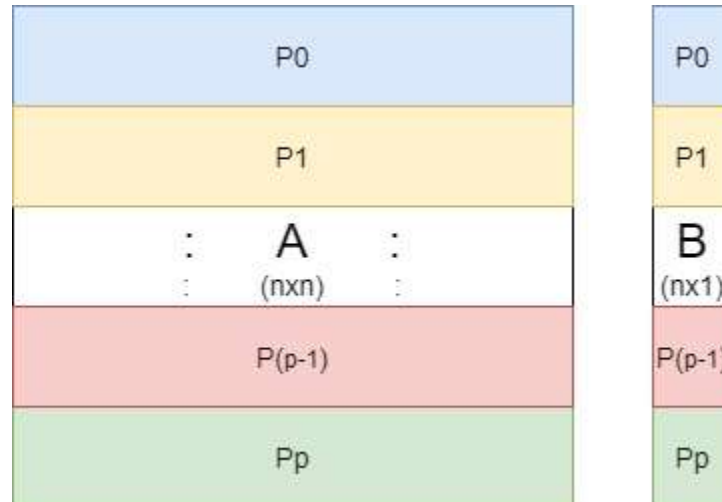# Project 1
CSCI 475 – Parallel Computing
Saint Cloud State University

Mark Christenson

2. Distribution.c

Observations

The data set used for the tested instance for Distribution.c contains 4096 to create a 64x64 matrix, call it matrix A. A vector, call it b, with 64 elements is generated by counting 1 to 64. Both A and b are partitioned into even sizes which processes are able to be assigned. If 4 processes are being assigned, 16 rows of A and 16 elements of b are assigned to each process. With a square nxn matrix, an n sized b vector, and p processes, the number of rows of A and b to be assigned to each process can be computed with n/p. The number of elements of A to be assigned is equal to $(n^2)/p$ = rows x n. After computing the number of elements, those elements can be sent using the scatter function.

Output

The data from matrix A received by process 1

5 23 30 53 12 37 97 2 47 98 17 33 83 12 35 98 65 7 98 94 2 56 25 66 68 9 79 3 96 62 91 96 49 52 7 72 37
88 11 98 66 46 23 86 28 27 1 78 98 12 92 41 82 68 74 34 84 3 38 60 5 23 41 69 4 91 34 65 29 47 73 76 14
7 6 78 55 27 85 33 16 15 31 20 44 90 58 28 52 16 50 36 50 85 85 33 28 48 48 53 76 44 14 23 41 80 52 32
90 96 54 52 21 67 90 12 74 56 74 18 17 74 26 94 73 51 38 36 3 50 21 74 31 12 95 59 84 20 96 48 22 22 1
14 63 42 74 8 59 64 41 74 69 23 15 6 13 62 36 59 83 79 68 39 76 22 95 1 60 32 72 70 39 65 77 59 12 94
42 76 15 55 36 88 54 32 76 57 42 63 77 5 46 69 45 40 64 48 55 20 35 44 61 91 98 52 23 92 47 4 48 65 25
69 27 14 58 53 74 42 96 63 78 42 15 41 82 82 80 64 2 20 91 36 14 78 17 81 35 76 36 100 60 97 7 18 5 74
91 26 48 69 78 81 18 98 62 35 17 44 34 51 57 2 91 40 23 43 49 54 4 71 23 34 19 47 8 18 19 44 71 10 11
22 58 36 63 98 75 79 58 18 11 25 100 89 14 43 58 79 47 40 7 97 39 42 41 92 40 48 40 30 40 19 19 34 72
15 69 25 58 84 58 77 56 6 62 69 58 50 88 21 25 47 15 71 30 15 45 94 19 33 1 70 81 83 31 12 14 79 53 60
31 20 8 68 48 46 35 27 66 21 100 17 1 86 21 4 56 94 96 24 54 97 53 59 30 23 48 77 21 24 55 42 62 37 78
51 30 40 5 5 30 100 12 92 90 71 76 65 91 44 62 30 23 64 77 54 39 10 81 23 89 46 2 43 3 8 69 99 80 82 9
42 94 87 20 17 72 16 57 89 96 46 85 9 35 98 5 10 8 70 79 65 14 49 50 91 18 60 99 27 41 70 46 71 14 33
97 72 26 10 27 4 11 71 52 96 98 66 32 39 17 13 97 20 61 68 77 47 24 7 20 31 21 4 2 22 98 75 19 53 98 77
11 66 93 6 21 12 21 5 39 85 66 73 36 54 56 12 48 30 19 43 63 15 24 58 89 82 2 74 69 29 99 72 21 92 80
94 57 15 42 20 1 17 35 32 32 46 93 61 58 88 48 26 29 100 58 39 44 72 62 71 40 19 5 61 96 29 61 64 99
47 35 20 15 2 52 94 64 16 30 59 57 98 8 90 62 45 95 22 59 2 66 33 31 48 24 42 97 49 5 64 27 60 34 84 36
33 97 85 84 33 93 26 49 99 9 60 77 59 3 56 17 82 51 75 15 23 64 84 75 57 31 94 31 80 13 95 45 64 95 15
54 39 72 13 67 55 45 83 34 25 54 57 26 80 67 36 40 28 66 59 7 80 6 77 69 85 39 36 42 45 24 14 7 93 57
46 99 63 59 89 31 43 48 13 20 58 15 5 25 23 68 75 92 78 16 87 77 26 80 64 22 88 74 100 18 60 71 83 56
42 75 28 5 17 54 79 85 42 80 58 66 85 7 75 23 4 92 50 32 68 35 35 1 31 51 74 100 22 98 21 75 12 32 5 38
4 70 17 1 88 57 27 33 97 88 76 80 72 82 15 50 18 70 13 57 8 49 59 80 34 94 59 47 50 88 44 82 99 61 53
37 74 93 28 67 55 13 30 34 25 49 49 22 96 52 93 51 83 3 1 84 1 75 67 25 62 82 21 33 46 92 88 56 78 54
28 87 68 16 21 82 100 7 38 44 34 9 45 10 78 100 26 16 34 93 83 17 51 98 67 58 98 26 58 76 3 51 84 46
87 31 9 43 63 19 89 58 77 37 71 43 11 46 19 90 25 32 84 86 46 8 31 97 54 58 34 70 50 43 40 15 12 92 54
62 73 93 29 73 76 65 44 25 97 24 80 55 78 40 82 56 5 96 18 3 58 82 94 72 46 8 56 28 16 62 51 38 55 90 3
44 68 87 76 14 9 2 65 38 74 65 57 72 15 98 81 64 31 93 80 38 11 73 48 65 54 72 69 32 55 84 11 97 92 28
47 30 18 64 17 4 40 88 29 6 20 95 31 11 40 14 41 83 98 10 51 47 58 52 76 23 87 68 4 32 40 80 72 83 20
42 30 96 44 19 17 85 65 85 99 49 29 39 61 44 81 43 54 2 5 97 80 20 91 46 24 26 12 36 4 2 7 84 18 92 39
3 82 94 53

1 going to wait
1 done waiting
The data from matrix A received by process 2

0 96 21 22 91 64 49 39 45 30 97 81 35 89 87 65 75 61 27 53 82 99 49 36 54 82 80 84 53 16 8 49 88 27 16
52 58 37 85 69 70 40 73 21 58 50 43 7 93 60 58 18 44 85 36 18 96 78 25 15 75 83 28 79 76 80 26 30 28 9
92 69 55 67 13 2 26 77 33 41 18 21 48 11 73 22 35 34 7 13 27 53 79 19 42 97 75 63 50 17 21 12 8 94 20
78 74 46 95 24 60 17 88 60 36 77 88 42 41 86 61 13 97 89 72 91 65 54 64 4 64 11 26 10 86 32 66 24 20
20 89 43 49 17 53 16 99 38 79 48 74 8 87 92 20 99 25 77 2 27 66 50 49 95 25 43 45 64 43 14 86 4 97 96

52 17 80 47 88 1 93 77 11 28 26 51 19 32 12 15 48 55 91 71 61 58 3 15 54 29 85 40 20 55 41 10 8 83 53
63 32 75 50 37 20 100 68 10 95 51 36 22 56 38 62 17 63 70 77 69 12 99 38 18 40 72 6 48 81 17 99 29 95
90 29 8 24 78 19 41 83 64 33 77 69 5 51 65 24 14 93 86 37 39 36 12 3 71 13 47 60 74 4 93 84 45 80 1 40
38 2 71 100 23 71 38 88 79 46 74 23 46 69 14 73 8 90 41 48 41 44 75 93 79 95 94 16 93 50 38 7 22 52 46
66 25 54 55 36 12 19 26 77 7 47 5 21 26 27 78 76 53 53 8 47 79 16 22 10 89 52 1 54 64 91 64 8 45 78 58
30 48 90 51 46 76 9 83 9 9 29 83 74 87 87 89 83 50 95 19 31 73 96 51 4 27 54 10 27 36 43 72 42 32 91 70
29 49 65 71 16 70 19 68 28 36 61 32 20 32 77 82 46 61 27 12 66 72 25 91 66 29 82 32 67 31 42 91 99 94
25 66 19 13 73 97 34 3 89 19 67 90 84 27 100 14 53 15 76 14 4 33 42 100 89 5 94 10 75 38 35 32 32 64
45 36 83 21 61 36 18 71 20 87 57 22 76 71 19 62 25 37 7 78 10 37 61 94 98 91 6 23 62 23 26 69 83 37 21
81 89 96 60 44 38 79 88 58 35 80 95 19 66 81 98 28 3 73 27 9 84 32 100 13 71 37 47 17 13 71 11 34 1 53
91 97 65 83 82 8 41 6 90 95 70 19 57 97 25 83 77 28 75 13 35 25 67 60 3 15 34 22 57 21 22 26 55 60 42
46 93 68 33 20 9 30 2 82 81 89 55 91 41 95 88 44 41 31 93 55 30 9 42 39 80 45 83 72 60 31 29 72 91 54
24 74 23 4 17 31 80 66 45 98 41 64 63 95 28 91 66 95 32 77 86 25 14 53 61 33 14 79 77 34 94 34 37 65
99 64 60 84 47 34 89 79 3 54 31 34 58 81 10 98 45 72 74 21 12 16 100 60 57 44 63 59 4 28 97 100 11 32
2 95 95 59 88 26 82 88 12 87 6 100 24 62 5 77 37 85 75 59 55 45 62 98 55 7 72 11 75 63 22 94 36 40 78
23 49 71 66 59 87 44 95 97 13 95 13 86 32 79 17 90 86 65 99 88 8 63 30 44 80 55 36 75 46 57 6 31 21 63
42 99 24 88 35 12 56 47 67 89 71 23 72 41 99 71 37 96 70 42 25 7 28 46 48 3 7 48 1 38 95 26 64 72 50 32
13 1 74 20 33 52 89 63 19 92 67 91 49 4 82 20 55 100 42 63 92 41 84 76 1 54 65 58 83 81 82 15 1 40 94
54 73 37 14 77 21 82 9 34 33 1 72 69 67 79 55 31 99 59 32 30 61 41 35 77 51 31 28 73 87 61 85 3 21 48
99 36 92 64 46 87 91 42 59 86 21 47 70 96 30 59 100 29 16 16 51 6 17 99 19 66 39 79 23 1 35 91 52 5 23
50 13 78 21 25 20 98 29 33 68 13 47 82 24 85 88 79 30 81 31 63 11 23 77 63 55 24 13 40 72 79 94 100 80
52 89 76 90 30 83 49 100 14 43 4 31 75 8 22 98 19 38 71 86 59 1 5 5 58 46 41 16 78 61 98 59 96 58 65 62
61 92 95 95 76 78 40 41 34 60 84 55 11 54 9 9 91 96 45 39 5 26 76 63 54 100 43 39 6 92 26 16 71 14 91
21 22 45 72 95 58 44 95 9 94 24 31 14 26 24 14 26 76 44 62 18 52 67 24 80 27 19 99 27 100 54 72 17 85
66 18 61 7 40 1 39 18 58 95 81 68

2 going to wait
2 done waiting
The data from matrix A received by process 3
34 26 13 60 26 86 45 11 2 50 81 14 67 62 23 49 69 68 99 43 98 71 62 70 12 39 65 77 1 27 90 81 23 51 50
92 59 74 27 100 25 14 19 99 60 26 93 45 29 21 92 86 98 87 79 94 73 61 20 11 62 60 36 94 69 42 65 84 99
52 40 14 40 99 9 26 26 38 49 80 88 64 92 18 53 30 83 55 17 42 72 66 16 93 11 26 34 43 59 92 67 85 53
77 68 4 76 52 21 87 58 7 80 80 34 81 14 63 71 26 53 44 96 40 2 32 96 61 28 13 40 53 13 73 90 41 7 48 48
44 69 93 81 5 59 11 99 69 35 24 63 6 78 45 77 72 62 47 63 75 77 2 55 78 90 52 30 55 10 40 64 14 26 47
34 82 24 43 39 49 67 83 66 24 62 46 6 79 99 83 7 9 88 76 92 28 82 61 82 58 10 8 100 19 13 79 92 43 22
57 77 70 26 81 84 34 67 67 16 92 17 20 13 31 53 56 17 69 6 46 42 90 22 28 78 26 16 51 51 82 55 49 49
23 96 98 7 54 27 48 78 83 20 74 24 99 75 50 31 19 76 49 92 80 41 4 23 16 89 100 100 62 2 71 60 44 88
45 16 63 36 48 41 5 44 96 9 39 12 18 13 70 74 23 15 87 49 51 2 79 14 30 87 36 91 23 94 17 21 44 54 2 61
81 89 88 53 44 91 2 67 39 13 56 46 52 9 67 41 10 20 53 45 13 79 86 34 64 70 99 4 77 46 6 58 77 53 75 51
76 19 1 92 47 91 63 70 91 67 36 60 41 96 17 60 61 5 55 27 72 85 97 82 5 51 3 58 89 98 83 34 21 65 10 24
28 12 83 24 66 72 71 100 56 16 32 45 53 48 16 10 73 74 92 67 20 43 86 83 56 35 14 66 43 60 32 77 55 84
86 18 71 97 43 36 19 76 65 79 74 17 67 12 83 50 10 67 85 26 42 32 4 81 7 48 9 57 64 20 88 54 58 95 39
37 53 28 81 81 100 74 8 80 38 3 8 29 94 59 34 26 83 85 11 23 18 70 61 99 100 1 70 75 58 63 38 17 96 80
15 7 98 9 15 56 85 8 3 70 57 81 1 56 85 10 7 30 12 97 5 23 23 85 70 10 27 94 72 12 28 49 14 37 62 94 51
93 59 68 7 69 97 74 95 94 53 52 78 70 68 22 50 52 85 50 5 96 16 96 80 27 1 5 51 100 8 8 11 97 72 33 17

36 85 11 24 68 86 73 60 22 38 3 80 39 27 94 13 41 85 5 75 86 60 37 61 91 64 92 64 61 96 9 81 16 73 63
32 70 8 18 79 6 59 34 42 88 88 27 87 96 42 25 70 8 80 13 27 19 3 84 10 72 3 14 35 96 57 97 70 75 12 47
77 83 74 2 26 98 100 75 2 85 8 60 15 66 29 18 52 64 76 61 89 3 22 18 98 38 78 51 88 19 9 37 20 53 39 98
86 21 92 80 92 41 10 11 30 91 72 18 25 13 44 59 9 25 77 36 80 10 24 60 76 99 47 46 22 24 55 44 19 7 51
36 7 68 24 12 73 40 100 99 26 94 13 18 46 92 22 99 39 89 89 88 23 31 31 16 88 10 68 95 17 53 29 82 84
13 3 28 2 92 33 55 15 45 37 75 51 20 71 93 92 58 83 3 92 22 28 34 73 70 5 35 16 58 70 74 47 97 78 60 46
16 88 4 44 71 12 64 5 14 99 77 70 7 93 69 81 73 34 39 23 30 63 84 51 68 15 16 8 80 25 70 73 8 4 73 48
27 44 55 32 70 47 67 95 33 84 50 56 3 6 53 96 62 92 26 28 59 31 28 94 29 97 56 51 51 53 9 48 34 87 46
20 7 10 23 74 10 99 42 23 29 95 11 45 80 83 77 21 64 83 82 22 20 61 12 84 54 4 38 56 91 5 39 32 70 16
89 66 82 58 5 20 86 81 33 38 97 41 53 43 71 94 62 65 38 25 100 83 16 80 39 32 4 40 29 30 26 21 93 16
69 93 67 91 3 73 18 95 43 44 2 10 27 84 68 9 71 46 79 57 62 73 68 92 17 46 84 80 100 42 8 92 98 85 88
50 32 5 52 59 82 54 37 5 100 65 16 30 82 23 9 90 3 31 33 71 19 54 95 87 76 22 92 77 37 53 61 48 48 44
34 60 90 7 36 18 88 14 7 94 44 68 81 66 12 67 26 22 70 9 28 55 57 2 86 81 27 65 40 68 52 47 9 44 78 53
13 39 40 2

3 going to wait
3 done waiting
The data from matrix A received by process 0
96 5 70 87 57 74 89 1 10 86 77 37 12 94 99 83 3 4 82 35 58 36 24 60 53 52 62 70 32 64 2 24 38 24 53 21
32 27 73 55 47 64 37 28 35 92 67 57 78 71 29 20 16 34 59 38 68 36 27 9 86 43 74 30 51 41 59 51 38 64
45 35 48 83 86 90 47 22 69 94 46 76 11 78 68 34 21 2 86 51 41 51 98 90 8 96 93 96 19 1 95 79 72 28 30
46 10 78 72 5 72 47 77 67 95 55 4 2 71 58 84 59 79 55 11 43 15 6 78 53 9 72 23 77 79 22 95 36 44 60 66
29 69 27 89 51 30 9 75 72 65 5 91 70 94 61 60 72 67 70 97 23 10 11 75 90 13 98 28 62 22 80 86 54 11 10
84 18 63 75 97 17 10 4 45 53 41 54 55 58 93 26 89 76 78 11 33 61 47 95 62 52 25 63 18 39 71 32 9 46 91
2 53 77 74 45 72 28 21 28 99 45 81 9 80 30 76 38 46 31 76 85 44 50 36 44 15 17 49 26 96 32 46 13 29 64
50 10 42 35 5 62 92 49 38 80 77 62 73 10 31 49 89 33 5 56 15 67 66 89 64 84 25 28 67 12 4 58 54 14 49
65 74 69 6 57 65 30 32 31 49 19 2 93 94 30 91 57 64 61 53 57 28 24 92 33 3 15 58 10 89 30 92 100 48 83
5 91 22 43 17 83 86 67 37 19 94 32 65 26 89 57 94 97 15 32 77 9 9 15 39 9 20 24 27 2 54 11 93 9 56 99
84 52 79 4 51 81 82 56 70 87 38 39 4 19 82 83 72 62 14 15 56 43 3 63 53 60 29 6 98 40 71 7 37 91 58 58
51 6 37 9 68 20 100 100 66 37 16 81 21 57 21 100 55 40 45 36 92 77 80 66 88 84 1 66 24 40 64 31 51 53
36 99 66 89 38 7 26 32 55 63 16 10 7 61 9 64 50 62 7 47 92 1 92 40 95 45 14 23 44 9 58 55 74 58 88 81
22 44 31 28 67 20 97 21 23 6 30 14 11 57 82 80 52 99 36 82 99 31 21 88 87 51 80 12 72 83 42 65 29 3 93
77 9 77 89 81 27 83 91 92 44 61 81 41 61 58 86 48 17 48 74 98 88 66 57 63 9 29 85 2 9 57 88 75 61 84 94
99 84 57 30 72 88 47 85 82 23 88 32 51 5 8 90 74 48 69 29 50 54 49 51 33 22 89 60 81 58 87 70 35 68 99
21 95 44 78 56 39 49 13 68 39 14 24 95 52 78 56 100 15 35 85 29 57 68 92 85 65 65 94 51 73 59 93 66 40
64 51 3 72 91 31 52 28 48 99 35 60 95 67 74 39 99 15 23 93 17 73 3 25 97 71 59 13 44 4 71 25 26 16 90
88 79 88 42 5 8 65 36 74 23 55 87 74 23 75 50 8 52 80 22 2 67 84 24 11 84 70 71 32 37 27 58 53 10 40 93
27 82 50 40 57 61 51 7 4 70 91 8 95 27 45 78 3 6 25 68 38 15 14 98 50 55 60 65 17 95 21 92 54 45 11 74
30 14 27 3 53 97 25 19 30 3 73 12 74 39 12 86 91 12 97 87 71 29 85 21 49 48 77 29 82 70 64 42 61 61 4 5
48 83 97 41 77 15 83 26 61 14 27 62 50 59 29 4 91 70 8 45 40 57 99 23 11 48 87 35 42 91 81 46 50 97 21
28 84 39 3 90 17 2 45 60 83 13 29 80 38 75 21 76 32 87 24 58 77 64 54 91 49 63 99 59 95 67 39 39 86 61
10 70 62 99 39 24 42 38 30 79 15 67 14 4 87 74 63 86 51 93 100 97 46 78 44 70 15 12 91 85 8 3 23 68 20
27 40 50 66 41 7 97 91 27 41 64 22 97 8 23 10 32 22 89 16 80 18 45 17 72 7 64 58 29 38 50 19 28 40 82
16 31 48 63 74 58 81 8 5 40 63 18 66 37 42 19 28 84 28 75 11 49 81 83 32 80 64 14 54 2 63 12 40 31 53
67 40 21 75 35 92 29 77 53 99 23 83 56 6 46 99 56 39 64 4 70 78 67 56 23 26 42 58 84 2 66 99 6 37 68 58

99 90 29 41 5 96 91 22 14 58 32 62 11 18 64 25 29 31 12 46 9 39 31 4 54 54 72 41 36 80 42 62 64 97 83 59 22 11 36 69 58 47 11 61 66 100 55 22 20 12 72 42 64 97 74 5 63 3 88 79 50 91 75 47 44 91 37 16 17 34 11 95

0 waited
The data recieved from vector b recieved by process 0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
The data recieved from vector b recieved by process 3
49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64
The data recieved from vector b recieved by process 1
17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
The data recieved from vector b recieved by process 2
33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48

 [oz5808sg@csci4 Project 1]$ mpiexec -n 16 ./Distribute.out
The data from matrix A received by process 0
96 5 70 87 57 74 89 1 10 86 77 37 12 94 99 83 3 4 82 35 58 36 24 60 53 52 62 70 32 64 2 24 38 24 53 21 32 27 73 55 47 64 37 28 35 92 67 57 78 71 29 20 16 34 59 38 68 36 27 9 86 43 74 30 51 41 59 51 38 64 45 35 48 83 86 90 47 22 69 94 46 76 11 78 68 34 21 2 86 51 41 51 98 90 8 96 93 96 19 1 95 79 72 28 30 46 10 78 72 5 72 47 77 67 95 55 4 2 71 58 84 59 79 55 11 43 15 6 78 53 9 72 23 77 79 22 95 36 44 60 66 29 69 27 89 51 30 9 75 72 65 5 91 70 94 61 60 72 67 70 97 23 10 11 75 90 13 98 28 62 22 80 86 54 11 10 84 18 63 75 97 17 10 4 45 53 41 54 55 58 93 26 89 76 78 11 33 61 47 95 62 52 25 63 18 39 71 32 9 46 91 2 53 77 74 45 72 28 21 28 99 45 81 9 80 30 76 38 46 31 76 85 44 50 36 44 15 17 49 26 96 32 46 13 29 64 50 10 42 35 5 62 92 49 38 80

The data from matrix A received by process 10
100 13 71 37 47 17 13 71 11 34 1 53 91 97 65 83 82 8 41 6 90 95 70 19 57 97 25 83 77 28 75 13 35 25 67 60 3 15 34 22 57 21 22 26 55 60 42 46 93 68 33 20 9 30 2 82 81 89 55 91 41 95 88 44 41 31 93 55 30 9 42 39 80 45 83 72 60 31 29 72 91 54 24 74 23 4 17 31 80 66 45 98 41 64 63 95 28 91 66 95 32 77 86 25 14 53 61 33 14 79 77 34 94 34 37 65 99 64 60 84 47 34 89 79 3 54 31 34 58 81 10 98 45 72 74 21 12 16 100 60 57 44 63 59 4 28 97 100 11 32 2 95 95 59 88 26 82 88 12 87 6 100 24 62 5 77 37 85 75 59 55 45 62 98 55 7 72 11 75 63 22 94 36 40 78 23 49 71 66 59 87 44 95 97 13 95 13 86 32 79 17 90 86 65 99 88 8 63 30 44 80 55 36 75 46 57 6 31 21 63 42 99 24 88 35 12 56 47 67 89 71 23 72 41 99 71 37 96 70 42 25 7 28 46 48 3 7 48 1 38 95 26 64 72 50 32

10 going to wait
10 done waiting
The data from matrix A received by process 2
74 98 88 66 57 63 9 29 85 2 9 57 88 75 61 84 94 99 84 57 30 72 88 47 85 82 23 88 32 51 5 8 90 74 48 69 29 50 54 49 51 33 22 89 60 81 58 87 70 35 68 99 21 95 44 78 56 39 49 13 68 39 14 24 95 52 78 56 100 15 35 85 29 57 68 92 85 65 65 94 51 73 59 93 66 40 64 51 3 72 91 31 52 28 48 99 35 60 95 67 74 39 99 15 23 93 17 73 3 25 97 71 59 13 44 4 71 25 26 16 90 88 79 88 42 5 8 65 36 74 23 55 87 74 23 75 50 8 52 80 22 2 67 84 24 11 84 70 71 32 37 27 58 53 10 40 93 27 82 50 40 57 61 51 7 4 70 91 8 95 27 45 78 3 6 25 68 38 15 14 98 50 55 60 65 17 95 21 92 54 45 11 74 30 14 27 3 53 97 25 19 30 3 73 12 74 39 12 86 91 12

97 87 71 29 85 21 49 48 77 29 82 70 64 42 61 61 4 5 48 83 97 41 77 15 83 26 61 14 27 62 50 59 29 4 91 70 8 45 40 57 99 23 11 48 87

2 going to wait
2 done waiting
The data from matrix A received by process 14
85 70 10 27 94 72 12 28 49 14 37 62 94 51 93 59 68 7 69 97 74 95 94 53 52 78 70 68 22 50 52 85 50 5 96 16 96 80 27 1 5 51 100 8 8 11 97 72 33 17 36 85 11 24 68 86 73 60 22 38 3 80 39 27 94 13 41 85 5 75 86 60 37 61 91 64 92 64 61 96 9 81 16 73 63 32 70 8 18 79 6 59 34 42 88 88 27 87 96 42 25 70 8 80 13 27 19 3 84 10 72 3 14 35 96 57 97 70 75 12 47 77 83 74 2 26 98 100 75 2 85 8 60 15 66 29 18 52 64 76 61 89 3 22 18 98 38 78 51 88 19 9 37 20 53 39 98 86 21 92 80 92 41 10 11 30 91 72 18 25 13 44 59 9 25 77 36 80 10 24 60 76 99 47 46 22 24 55 44 19 7 51 36 7 68 24 12 73 40 100 99 26 94 13 18 46 92 22 99 39 89 89 88 23 31 31 16 88 10 68 95 17 53 29 82 84 13 3 28 2 92 33 55 15 45 37 75 51 20 71 93 92 58 83 3 92 22 28 34 73 70 5 35 16 58 70

14 going to wait
14 done waiting
The data from matrix A received by process 11
13 1 74 20 33 52 89 63 19 92 67 91 49 4 82 20 55 100 42 63 92 41 84 76 1 54 65 58 83 81 82 15 1 40 94 54 73 37 14 77 21 82 9 34 33 1 72 69 67 79 55 31 99 59 32 30 61 41 35 77 51 31 28 73 87 61 85 3 21 48 99 36 92 64 46 87 91 42 59 86 21 47 70 96 30 59 100 29 16 16 51 6 17 99 19 66 39 79 23 1 35 91 52 5 23 50 13 78 21 25 20 98 29 33 68 13 47 82 24 85 88 79 30 81 31 63 11 23 77 63 55 24 13 40 72 79 94 100 80 52 89 76 90 30 83 49 100 14 43 4 31 75 8 22 98 19 38 71 86 59 1 5 5 58 46 41 16 78 61 98 59 96 58 65 62 61 92 95 95 76 78 40 41 34 60 84 55 11 54 9 9 91 96 45 39 5 26 76 63 54 100 43 39 6 92 26 16 71 14 91 21 22 45 72 95 58 44 95 9 94 24 31 14 26 24 14 26 76 44 62 18 52 67 24 80 27 19 99 27 100 54 72 17 85 66 18 61 7 40 1 39 18 58 95 81 68

11 going to wait
11 done waiting
The data from matrix A received by process 9
51 65 24 14 93 86 37 39 36 12 3 71 13 47 60 74 4 93 84 45 80 1 40 38 2 71 100 23 71 38 88 79 46 74 23 46 69 14 73 8 90 41 48 41 44 75 93 79 95 94 16 93 50 38 7 22 52 46 66 25 54 55 36 12 19 26 77 7 47 5 21 26 27 78 76 53 53 8 47 79 16 22 10 89 52 1 54 64 91 64 8 45 78 58 30 48 90 51 46 76 9 83 9 9 29 83 74 87 87 89 83 50 95 19 31 73 96 51 4 27 54 10 27 36 43 72 42 32 91 70 29 49 65 71 16 70 19 68 28 36 61 32 20 32 77 82 46 61 27 12 66 72 25 91 66 29 82 32 67 31 42 91 99 94 25 66 19 13 73 97 34 3 89 19 67 90 84 27 100 14 53 15 76 14 4 33 42 100 89 5 94 10 75 38 35 32 32 64 45 36 83 21 61 36 18 71 20 87 57 22 76 71 19 62 25 37 7 78 10 37 61 94 98 91 6 23 62 23 26 69 83 37 21 81 89 96 60 44 38 79 88 58 35 80 95 19 66 81 98 28 3 73 27 9 84 32

9 going to wait
9 done waiting
The data from matrix A received by process 6
19 43 63 15 24 58 89 82 2 74 69 29 99 72 21 92 80 94 57 15 42 20 1 17 35 32 32 46 93 61 58 88 48 26 29 100 58 39 44 72 62 71 40 19 5 61 96 29 61 64 99 47 35 20 15 2 52 94 64 16 30 59 57 98 8 90 62 45 95 22 59 2 66 33 31 48 24 42 97 49 5 64 27 60 34 84 36 33 97 85 84 33 93 26 49 99 9 60 77 59 3 56 17 82 51 75

15 23 64 84 75 57 31 94 31 80 13 95 45 64 95 15 54 39 72 13 67 55 45 83 34 25 54 57 26 80 67 36 40 28 66 59 7 80 6 77 69 85 39 36 42 45 24 14 7 93 57 46 99 63 59 89 31 43 48 13 20 58 15 5 25 23 68 75 92 78 16 87 77 26 80 64 22 88 74 100 18 60 71 83 56 42 75 28 5 17 54 79 85 42 80 58 66 85 7 75 23 4 92 50 32 68 35 35 1 31 51 74 100 22 98 21 75 12 32 5 38 4 70 17 1 88 57 27 33 97 88 76 80 72 82 15 50 18 70 13 57 8 49 59 80 34 94 59 47 50

6 going to wait
6 done waiting
The data from matrix A received by process 12
34 26 13 60 26 86 45 11 2 50 81 14 67 62 23 49 69 68 99 43 98 71 62 70 12 39 65 77 1 27 90 81 23 51 50 92 59 74 27 100 25 14 19 99 60 26 93 45 29 21 92 86 98 87 79 94 73 61 20 11 62 60 36 94 69 42 65 84 99 52 40 14 40 99 9 26 26 38 49 80 88 64 92 18 53 30 83 55 17 42 72 66 16 93 11 26 34 43 59 92 67 85 53 77 68 4 76 52 21 87 58 7 80 80 34 81 14 63 71 26 53 44 96 40 2 32 96 61 28 13 40 53 13 73 90 41 7 48 48 44 69 93 81 5 59 11 99 69 35 24 63 6 78 45 77 72 62 47 63 75 77 2 55 78 90 52 30 55 10 40 64 14 26 47 34 82 24 43 39 49 67 83 66 24 62 46 6 79 99 83 7 9 88 76 92 28 82 61 82 58 10 8 100 19 13 79 92 43 22 57 77 70 26 81 84 34 67 67 16 92 17 20 13 31 53 56 17 69 6 46 42 90 22 28 78 26 16 51 51 82 55 49 49 23 96 98 7 54 27 48 78 83 20 74 24 99

12 going to wait
12 done waiting
The data from matrix A received by process 3
35 42 91 81 46 50 97 21 28 84 39 3 90 17 2 45 60 83 13 29 80 38 75 21 76 32 87 24 58 77 64 54 91 49 63 99 59 95 67 39 39 86 61 10 70 62 99 39 24 42 38 30 79 15 67 14 4 87 74 63 86 51 93 100 97 46 78 44 70 15 12 91 85 8 3 23 68 20 27 40 50 66 41 7 97 91 27 41 64 22 97 8 23 10 32 22 89 16 80 18 45 17 72 7 64 58 29 38 50 19 28 40 82 16 31 48 63 74 58 81 8 5 40 63 18 66 37 42 19 28 84 28 75 11 49 81 83 32 80 64 14 54 2 63 12 40 31 53 67 40 21 75 35 92 29 77 53 99 23 83 56 6 46 99 56 39 64 4 70 78 67 56 23 26 42 58 84 2 66 99 6 37 68 58 99 90 29 41 5 96 91 22 14 58 32 62 11 18 64 25 29 31 12 46 9 39 31 4 54 54 72 41 36 80 42 62 64 97 83 59 22 11 36 69 58 47 11 61 66 100 55 22 20 12 72 42 64 97 74 5 63 3 88 79 50 91 75 47 44 91 37 16 17 34 11 95

3 going to wait
3 done waiting
The data from matrix A received by process 4
5 23 30 53 12 37 97 2 47 98 17 33 83 12 35 98 65 7 98 94 2 56 25 66 68 9 79 3 96 62 91 96 49 52 7 72 37 88 11 98 66 46 23 86 28 27 1 78 98 12 92 41 82 68 74 34 84 3 38 60 5 23 41 69 4 91 34 65 29 47 73 76 14 7 6 78 55 27 85 33 16 15 31 20 44 90 58 28 52 16 50 36 50 85 85 33 28 48 48 53 76 44 14 23 41 80 52 32 90 96 54 52 21 67 90 12 74 56 74 18 17 74 26 94 73 51 38 36 3 50 21 74 31 12 95 59 84 20 96 48 22 22 1 14 63 42 74 8 59 64 41 74 69 23 15 6 13 62 36 59 83 79 68 39 76 22 95 1 60 32 72 70 39 65 77 59 12 94 42 76 15 55 36 88 54 32 76 57 42 63 77 5 46 69 45 40 64 48 55 20 35 44 61 91 98 52 23 92 47 4 48 65 25 69 27 14 58 53 74 42 96 63 78 42 15 41 82 82 80 64 2 20 91 36 14 78 17 81 35 76 36 100 60 97 7 18 5 74 91 26 48 69 78 81 18 98

4 going to wait
4 done waiting
The data from matrix A received by process 13

75 50 31 19 76 49 92 80 41 4 23 16 89 100 100 62 2 71 60 44 88 45 16 63 36 48 41 5 44 96 9 39 12 18 13 70 74 23 15 87 49 51 2 79 14 30 87 36 91 23 94 17 21 44 54 2 61 81 89 88 53 44 91 2 67 39 13 56 46 52 9 67 41 10 20 53 45 13 79 86 34 64 70 99 4 77 46 6 58 77 53 75 51 76 19 1 92 47 91 63 70 91 67 36 60 41 96 17 60 61 5 55 27 72 85 97 82 5 51 3 58 89 98 83 34 21 65 10 24 28 12 83 24 66 72 71 100 56 16 32 45 53 48 16 10 73 74 92 67 20 43 86 83 56 35 14 66 43 60 32 77 55 84 86 18 71 97 43 36 19 76 65 79 74 17 67 12 83 50 10 67 85 26 42 32 4 81 7 48 9 57 64 20 88 54 58 95 39 37 53 28 81 81 100 74 8 80 38 3 8 29 94 59 34 26 83 85 11 23 18 70 61 99 100 1 70 75 58 63 38 17 96 80 15 7 98 9 15 56 85 8 3 70 57 81 1 56 85 10 7 30 12 97 5 23 23

13 going to wait
13 done waiting
The data from matrix A received by process 8
0 96 21 22 91 64 49 39 45 30 97 81 35 89 87 65 75 61 27 53 82 99 49 36 54 82 80 84 53 16 8 49 88 27 16 52 58 37 85 69 70 40 73 21 58 50 43 7 93 60 58 18 44 85 36 18 96 78 25 15 75 83 28 79 76 80 26 30 28 9 92 69 55 67 13 2 26 77 33 41 18 21 48 11 73 22 35 34 7 13 27 53 79 19 42 97 75 63 50 17 21 12 8 94 20 78 74 46 95 24 60 17 88 60 36 77 88 42 41 86 61 13 97 89 72 91 65 54 64 4 64 11 26 10 86 32 66 24 20 20 89 43 49 17 53 16 99 38 79 48 74 8 87 92 20 99 25 77 2 27 66 50 49 95 25 43 45 64 43 14 86 4 97 96 52 17 80 47 88 1 93 77 11 28 26 51 19 32 12 15 48 55 91 71 61 58 3 15 54 29 85 40 20 55 41 10 8 83 53 63 32 75 50 37 20 100 68 10 95 51 36 22 56 38 62 17 63 70 77 69 12 99 38 18 40 72 6 48 81 17 99 29 95 90 29 8 24 78 19 41 83 64 33 77 69 5

8 going to wait
8 done waiting
The data from matrix A received by process 5
62 35 17 44 34 51 57 2 91 40 23 43 49 54 4 71 23 34 19 47 8 18 19 44 71 10 11 22 58 36 63 98 75 79 58 18 11 25 100 89 14 43 58 79 47 40 7 97 39 42 41 92 40 48 40 30 40 19 19 34 72 15 69 25 58 84 58 77 56 6 62 69 58 50 88 21 25 47 15 71 30 15 45 94 19 33 1 70 81 83 31 12 14 79 53 60 31 20 8 68 48 46 35 27 66 21 100 17 1 86 21 4 56 94 96 24 54 97 53 59 30 23 48 77 21 24 55 42 62 37 78 51 30 40 5 5 30 100 12 92 90 71 76 65 91 44 62 30 23 64 77 54 39 10 81 23 89 46 2 43 3 8 69 99 80 82 9 42 94 87 20 17 72 16 57 89 96 46 85 9 35 98 5 10 8 70 79 65 14 49 50 91 18 60 99 27 41 70 46 71 14 33 97 72 26 10 27 4 11 71 52 96 98 66 32 39 17 13 97 20 61 68 77 47 24 7 20 31 21 4 2 22 98 75 19 53 98 77 11 66 93 6 21 12 21 5 39 85 66 73 36 54 56 12 48 30

5 going to wait
5 done waiting
The data from matrix A received by process 15
74 47 97 78 60 46 16 88 4 44 71 12 64 5 14 99 77 70 7 93 69 81 73 34 39 23 30 63 84 51 68 15 16 8 80 25 70 73 8 4 73 48 27 44 55 32 70 47 67 95 33 84 50 56 3 6 53 96 62 92 26 28 59 31 28 94 29 97 56 51 51 53 9 48 34 87 46 20 7 10 23 74 10 99 42 23 29 95 11 45 80 83 77 21 64 83 82 22 20 61 12 84 54 4 38 56 91 5 39 32 70 16 89 66 82 58 5 20 86 81 33 38 97 41 53 43 71 94 62 65 38 25 100 83 16 80 39 32 4 40 29 30 26 21 93 16 69 93 67 91 3 73 18 95 43 44 2 10 27 84 68 9 71 46 79 57 62 73 68 92 17 46 84 80 100 42 8 92 98 85 88 50 32 5 52 59 82 54 37 5 100 65 16 30 82 23 9 90 3 31 33 71 19 54 95 87 76 22 92 77 37 53 61 48 48 44 34 60 90 7 36 18 88 14 7 94 44 68 81 66 12 67 26 22 70 9 28 55 57 2 86 81 27 65 40 68 52 47 9 44 78 53 13 39 40 2

15 going to wait

15 done waiting

The data from matrix A received by process 7

88 44 82 99 61 53 37 74 93 28 67 55 13 30 34 25 49 49 22 96 52 93 51 83 3 1 84 1 75 67 25 62 82 21 33 46 92 88 56 78 54 28 87 68 16 21 82 100 7 38 44 34 9 45 10 78 100 26 16 34 93 83 17 51 98 67 58 98 26 58 76 3 51 84 46 87 31 9 43 63 19 89 58 77 37 71 43 11 46 19 90 25 32 84 86 46 8 31 97 54 58 34 70 50 43 40 15 12 92 54 62 73 93 29 73 76 65 44 25 97 24 80 55 78 40 82 56 5 96 18 3 58 82 94 72 46 8 56 28 16 62 51 38 55 90 3 44 68 87 76 14 9 2 65 38 74 65 57 72 15 98 81 64 31 93 80 38 11 73 48 65 54 72 69 32 55 84 11 97 92 28 47 30 18 64 17 4 40 88 29 6 20 95 31 11 40 14 41 83 98 10 51 47 58 52 76 23 87 68 4 32 40 80 72 83 20 42 30 96 44 19 17 85 65 85 99 49 29 39 61 44 81 43 54 2 5 97 80 20 91 46 24 26 12 36 4 2 7 84 18 92 39 3 82 94 53

7 going to wait

7 done waiting

The data from matrix A received by process 1

77 62 73 10 31 49 89 33 5 56 15 67 66 89 64 84 25 28 67 12 4 58 54 14 49 65 74 69 6 57 65 30 32 31 49 19 2 93 94 30 91 57 64 61 53 57 28 24 92 33 3 15 58 10 89 30 92 100 48 83 5 91 22 43 17 83 86 67 37 19 94 32 65 26 89 57 94 97 15 32 77 9 9 15 39 9 20 24 27 2 54 11 93 9 56 99 84 52 79 4 51 81 82 56 70 87 38 39 4 19 82 83 72 62 14 15 56 43 3 63 53 60 29 6 98 40 71 7 37 91 58 58 51 6 37 9 68 20 100 100 66 37 16 81 21 57 21 100 55 40 45 36 92 77 80 66 88 84 1 66 24 40 64 31 51 53 36 99 66 89 38 7 26 32 55 63 16 10 7 61 9 64 50 62 7 47 92 1 92 40 95 45 14 23 44 9 58 55 74 58 88 81 22 44 31 28 67 20 97 21 23 6 30 14 11 57 82 80 52 99 36 82 99 31 21 88 87 51 80 12 72 83 42 65 29 3 93 77 9 77 89 81 27 83 91 92 44 61 81 41 61 58 86 48 17 48

1 going to wait

1 done waiting

0 waited

The data recieved from vector b recieved by process 0

1 2 3 4

The data recieved from vector b recieved by process 4

17 18 19 20

The data recieved from vector b recieved by process 6

25 26 27 28

The data recieved from vector b recieved by process 5

21 22 23 24

The data recieved from vector b recieved by process 2

9 10 11 12

The data recieved from vector b recieved by process 3

13 14 15 16

The data recieved from vector b recieved by process 8

33 34 35 36

The data recieved from vector b recieved by process 9

37 38 39 40

The data recieved from vector b recieved by process 10

41 42 43 44

The data recieved from vector b recieved by process 11
45 46 47 48
The data recieved from vector b recieved by process 14
57 58 59 60
The data recieved from vector b recieved by process 12
49 50 51 52
The data recieved from vector b recieved by process 13
53 54 55 56
The data recieved from vector b recieved by process 15
61 62 63 64
The data recieved from vector b recieved by process 1
5 6 7 8
The data recieved from vector b recieved by process 7
29 30 31 32

 [oz5808sg@csci4 Project 1]$ mpiexec -n 64 ./Distribute.out
The data from matrix A received by process 4
77 62 73 10 31 49 89 33 5 56 15 67 66 89 64 84 25 28 67 12 4 58 54 14 49 65 74 69 6 57 65 30 32 31 49
19 2 93 94 30 91 57 64 61 53 57 28 24 92 33 3 15 58 10 89 30 92 100 48 83 5 91 22 43

4 going to wait
4 done waiting
The data from matrix A received by process 6
37 91 58 58 51 6 37 9 68 20 100 100 66 37 16 81 21 57 21 100 55 40 45 36 92 77 80 66 88 84 1 66 24 40
64 31 51 53 36 99 66 89 38 7 26 32 55 63 16 10 7 61 9 64 50 62 7 47 92 1 92 40 95 45

6 going to wait
6 done waiting
The data from matrix A received by process 8
74 98 88 66 57 63 9 29 85 2 9 57 88 75 61 84 94 99 84 57 30 72 88 47 85 82 23 88 32 51 5 8 90 74 48 69
29 50 54 49 51 33 22 89 60 81 58 87 70 35 68 99 21 95 44 78 56 39 49 13 68 39 14 24

8 going to wait
8 done waiting
The data from matrix A received by process 9
95 52 78 56 100 15 35 85 29 57 68 92 85 65 65 94 51 73 59 93 66 40 64 51 3 72 91 31 52 28 48 99 35 60
95 67 74 39 99 15 23 93 17 73 3 25 97 71 59 13 44 4 71 25 26 16 90 88 79 88 42 5 8 65

9 going to wait
9 done waiting
The data from matrix A received by process 7
14 23 44 9 58 55 74 58 88 81 22 44 31 28 67 20 97 21 23 6 30 14 11 57 82 80 52 99 36 82 99 31 21 88 87
51 80 12 72 83 42 65 29 3 93 77 9 77 89 81 27 83 91 92 44 61 81 41 61 58 86 48 17 48

7 going to wait

17

7 done waiting
The data from matrix A received by process 10
36 74 23 55 87 74 23 75 50 8 52 80 22 2 67 84 24 11 84 70 71 32 37 27 58 53 10 40 93 27 82 50 40 57 61
51 7 4 70 91 8 95 27 45 78 3 6 25 68 38 15 14 98 50 55 60 65 17 95 21 92 54 45 11

10 going to wait
10 done waiting
The data from matrix A received by process 5
17 83 86 67 37 19 94 32 65 26 89 57 94 97 15 32 77 9 9 15 39 9 20 24 27 2 54 11 93 9 56 99 84 52 79 4
51 81 82 56 70 87 38 39 4 19 82 83 72 62 14 15 56 43 3 63 53 60 29 6 98 40 71 7

5 going to wait
5 done waiting
The data from matrix A received by process 11
74 30 14 27 3 53 97 25 19 30 3 73 12 74 39 12 86 91 12 97 87 71 29 85 21 49 48 77 29 82 70 64 42 61 61
4 5 48 83 97 41 77 15 83 26 61 14 27 62 50 59 29 4 91 70 8 45 40 57 99 23 11 48 87

11 going to wait
11 done waiting
The data from matrix A received by process 2
78 53 9 72 23 77 79 22 95 36 44 60 66 29 69 27 89 51 30 9 75 72 65 5 91 70 94 61 60 72 67 70 97 23 10
11 75 90 13 98 28 62 22 80 86 54 11 10 84 18 63 75 97 17 10 4 45 53 41 54 55 58 93 26

2 going to wait
2 done waiting
The data from matrix A received by process 3
89 76 78 11 33 61 47 95 62 52 25 63 18 39 71 32 9 46 91 2 53 77 74 45 72 28 21 28 99 45 81 9 80 30 76
38 46 31 76 85 44 50 36 44 15 17 49 26 96 32 46 13 29 64 50 10 42 35 5 62 92 49 38 80

3 going to wait
3 done waiting
The data from matrix A received by process 1
51 41 59 51 38 64 45 35 48 83 86 90 47 22 69 94 46 76 11 78 68 34 21 2 86 51 41 51 98 90 8 96 93 96 19
1 95 79 72 28 30 46 10 78 72 5 72 47 77 67 95 55 4 2 71 58 84 59 79 55 11 43 15 6

1 going to wait
1 done waiting
The data from matrix A received by process 12
35 42 91 81 46 50 97 21 28 84 39 3 90 17 2 45 60 83 13 29 80 38 75 21 76 32 87 24 58 77 64 54 91 49 63
99 59 95 67 39 39 86 61 10 70 62 99 39 24 42 38 30 79 15 67 14 4 87 74 63 86 51 93 100

12 going to wait
12 done waiting
The data from matrix A received by process 14

19 28 84 28 75 11 49 81 83 32 80 64 14 54 2 63 12 40 31 53 67 40 21 75 35 92 29 77 53 99 23 83 56 6 46 99 56 39 64 4 70 78 67 56 23 26 42 58 84 2 66 99 6 37 68 58 99 90 29 41 5 96 91 22

14 going to wait
14 done waiting
The data from matrix A received by process 13
97 46 78 44 70 15 12 91 85 8 3 23 68 20 27 40 50 66 41 7 97 91 27 41 64 22 97 8 23 10 32 22 89 16 80 18 45 17 72 7 64 58 29 38 50 19 28 40 82 16 31 48 63 74 58 81 8 5 40 63 18 66 37 42

13 going to wait
13 done waiting
The data from matrix A received by process 15
14 58 32 62 11 18 64 25 29 31 12 46 9 39 31 4 54 54 72 41 36 80 42 62 64 97 83 59 22 11 36 69 58 47 11 61 66 100 55 22 20 12 72 42 64 97 74 5 63 3 88 79 50 91 75 47 44 91 37 16 17 34 11 95

15 going to wait
15 done waiting
The data from matrix A received by process 16
5 23 30 53 12 37 97 2 47 98 17 33 83 12 35 98 65 7 98 94 2 56 25 66 68 9 79 3 96 62 91 96 49 52 7 72 37 88 11 98 66 46 23 86 28 27 1 78 98 12 92 41 82 68 74 34 84 3 38 60 5 23 41 69

16 going to wait
16 done waiting
The data from matrix A received by process 17
4 91 34 65 29 47 73 76 14 7 6 78 55 27 85 33 16 15 31 20 44 90 58 28 52 16 50 36 50 85 85 33 28 48 48 53 76 44 14 23 41 80 52 32 90 96 54 52 21 67 90 12 74 56 74 18 17 74 26 94 73 51 38 36

17 going to wait
17 done waiting
The data from matrix A received by process 18
3 50 21 74 31 12 95 59 84 20 96 48 22 22 1 14 63 42 74 8 59 64 41 74 69 23 15 6 13 62 36 59 83 79 68 39 76 22 95 1 60 32 72 70 39 65 77 59 12 94 42 76 15 55 36 88 54 32 76 57 42 63 77 5

18 going to wait
18 done waiting
The data from matrix A received by process 19
46 69 45 40 64 48 55 20 35 44 61 91 98 52 23 92 47 4 48 65 25 69 27 14 58 53 74 42 96 63 78 42 15 41 82 82 80 64 2 20 91 36 14 78 17 81 35 76 36 100 60 97 7 18 5 74 91 26 48 69 78 81 18 98

19 going to wait
19 done waiting
The data from matrix A received by process 20
62 35 17 44 34 51 57 2 91 40 23 43 49 54 4 71 23 34 19 47 8 18 19 44 71 10 11 22 58 36 63 98 75 79 58 18 11 25 100 89 14 43 58 79 47 40 7 97 39 42 41 92 40 48 40 30 40 19 19 34 72 15 69 25

20 going to wait

20 done waiting

The data from matrix A received by process 21

58 84 58 77 56 6 62 69 58 50 88 21 25 47 15 71 30 15 45 94 19 33 1 70 81 83 31 12 14 79 53 60 31 20 8 68 48 46 35 27 66 21 100 17 1 86 21 4 56 94 96 24 54 97 53 59 30 23 48 77 21 24 55 42

21 going to wait

21 done waiting

The data from matrix A received by process 24

19 43 63 15 24 58 89 82 2 74 69 29 99 72 21 92 80 94 57 15 42 20 1 17 35 32 32 46 93 61 58 88 48 26 29 100 58 39 44 72 62 71 40 19 5 61 96 29 61 64 99 47 35 20 15 2 52 94 64 16 30 59 57 98

24 going to wait

24 done waiting

The data from matrix A received by process 25

8 90 62 45 95 22 59 2 66 33 31 48 24 42 97 49 5 64 27 60 34 84 36 33 97 85 84 33 93 26 49 99 9 60 77 59 3 56 17 82 51 75 15 23 64 84 75 57 31 94 31 80 13 95 45 64 95 15 54 39 72 13 67 55

25 going to wait

25 done waiting

The data from matrix A received by process 26

45 83 34 25 54 57 26 80 67 36 40 28 66 59 7 80 6 77 69 85 39 36 42 45 24 14 7 93 57 46 99 63 59 89 31 43 48 13 20 58 15 5 25 23 68 75 92 78 16 87 77 26 80 64 22 88 74 100 18 60 71 83 56 42

26 going to wait

26 done waiting

The data from matrix A received by process 27

75 28 5 17 54 79 85 42 80 58 66 85 7 75 23 4 92 50 32 68 35 35 1 31 51 74 100 22 98 21 75 12 32 5 38 4 70 17 1 88 57 27 33 97 88 76 80 72 82 15 50 18 70 13 57 8 49 59 80 34 94 59 47 50

27 going to wait

27 done waiting

The data from matrix A received by process 28

88 44 82 99 61 53 37 74 93 28 67 55 13 30 34 25 49 49 22 96 52 93 51 83 3 1 84 1 75 67 25 62 82 21 33 46 92 88 56 78 54 28 87 68 16 21 82 100 7 38 44 34 9 45 10 78 100 26 16 34 93 83 17 51

28 going to wait

28 done waiting

The data from matrix A received by process 30

96 18 3 58 82 94 72 46 8 56 28 16 62 51 38 55 90 3 44 68 87 76 14 9 2 65 38 74 65 57 72 15 98 81 64 31 93 80 38 11 73 48 65 54 72 69 32 55 84 11 97 92 28 47 30 18 64 17 4 40 88 29 6 20

30 going to wait

30 done waiting

The data from matrix A received by process 31

95 31 11 40 14 41 83 98 10 51 47 58 52 76 23 87 68 4 32 40 80 72 83 20 42 30 96 44 19 17 85 65 85 99
49 29 39 61 44 81 43 54 2 5 97 80 20 91 46 24 26 12 36 4 2 7 84 18 92 39 3 82 94 53

31 going to wait
31 done waiting
The data recieved from vector b recieved by process 24
25
The data recieved from vector b recieved by process 25
26
The data recieved from vector b recieved by process 26
27
The data from matrix A received by process 29
98 67 58 98 26 58 76 3 51 84 46 87 31 9 43 63 19 89 58 77 37 71 43 11 46 19 90 25 32 84 86 46 8 31 97
54 58 34 70 50 43 40 15 12 92 54 62 73 93 29 73 76 65 44 25 97 24 80 55 78 40 82 56 5

29 going to wait
29 done waiting
The data recieved from vector b recieved by process 28
29
The data from matrix A received by process 33
76 80 26 30 28 9 92 69 55 67 13 2 26 77 33 41 18 21 48 11 73 22 35 34 7 13 27 53 79 19 42 97 75 63 50
17 21 12 8 94 20 78 74 46 95 24 60 17 88 60 36 77 88 42 41 86 61 13 97 89 72 91 65 54

33 going to wait
33 done waiting
The data from matrix A received by process 34
64 4 64 11 26 10 86 32 66 24 20 20 89 43 49 17 53 16 99 38 79 48 74 8 87 92 20 99 25 77 2 27 66 50 49
95 25 43 45 64 43 14 86 4 97 96 52 17 80 47 88 1 93 77 11 28 26 51 19 32 12 15 48 55

34 going to wait
34 done waiting
The data from matrix A received by process 35
91 71 61 58 3 15 54 29 85 40 20 55 41 10 8 83 53 63 32 75 50 37 20 100 68 10 95 51 36 22 56 38 62 17
63 70 77 69 12 99 38 18 40 72 6 48 81 17 99 29 95 90 29 8 24 78 19 41 83 64 33 77 69 5

35 going to wait
35 done waiting
The data from matrix A received by process 36
51 65 24 14 93 86 37 39 36 12 3 71 13 47 60 74 4 93 84 45 80 1 40 38 2 71 100 23 71 38 88 79 46 74 23
46 69 14 73 8 90 41 48 41 44 75 93 79 95 94 16 93 50 38 7 22 52 46 66 25 54 55 36 12

36 going to wait
36 done waiting
The data from matrix A received by process 37

19 26 77 7 47 5 21 26 27 78 76 53 53 8 47 79 16 22 10 89 52 1 54 64 91 64 8 45 78 58 30 48 90 51 46 76
9 83 9 9 29 83 74 87 87 89 83 50 95 19 31 73 96 51 4 27 54 10 27 36 43 72 42 32

37 going to wait
37 done waiting
The data from matrix A received by process 38
91 70 29 49 65 71 16 70 19 68 28 36 61 32 20 32 77 82 46 61 27 12 66 72 25 91 66 29 82 32 67 31 42 91
99 94 25 66 19 13 73 97 34 3 89 19 67 90 84 27 100 14 53 15 76 14 4 33 42 100 89 5 94 10

38 going to wait
38 done waiting
The data from matrix A received by process 39
75 38 35 32 32 64 45 36 83 21 61 36 18 71 20 87 57 22 76 71 19 62 25 37 7 78 10 37 61 94 98 91 6 23 62
23 26 69 83 37 21 81 89 96 60 44 38 79 88 58 35 80 95 19 66 81 98 28 3 73 27 9 84 32

39 going to wait
39 done waiting
The data from matrix A received by process 40
100 13 71 37 47 17 13 71 11 34 1 53 91 97 65 83 82 8 41 6 90 95 70 19 57 97 25 83 77 28 75 13 35 25 67
60 3 15 34 22 57 21 22 26 55 60 42 46 93 68 33 20 9 30 2 82 81 89 55 91 41 95 88 44

40 going to wait
40 done waiting
The data from matrix A received by process 41
41 31 93 55 30 9 42 39 80 45 83 72 60 31 29 72 91 54 24 74 23 4 17 31 80 66 45 98 41 64 63 95 28 91 66
95 32 77 86 25 14 53 61 33 14 79 77 34 94 34 37 65 99 64 60 84 47 34 89 79 3 54 31 34

41 going to wait
41 done waiting
The data from matrix A received by process 42
58 81 10 98 45 72 74 21 12 16 100 60 57 44 63 59 4 28 97 100 11 32 2 95 95 59 88 26 82 88 12 87 6 100
24 62 5 77 37 85 75 59 55 45 62 98 55 7 72 11 75 63 22 94 36 40 78 23 49 71 66 59 87 44

42 going to wait
42 done waiting
The data from matrix A received by process 43
95 97 13 95 13 86 32 79 17 90 86 65 99 88 8 63 30 44 80 55 36 75 46 57 6 31 21 63 42 99 24 88 35 12 56
47 67 89 71 23 72 41 99 71 37 96 70 42 25 7 28 46 48 3 7 48 1 38 95 26 64 72 50 32

43 going to wait
43 done waiting
The data from matrix A received by process 44
13 1 74 20 33 52 89 63 19 92 67 91 49 4 82 20 55 100 42 63 92 41 84 76 1 54 65 58 83 81 82 15 1 40 94
54 73 37 14 77 21 82 9 34 33 1 72 69 67 79 55 31 99 59 32 30 61 41 35 77 51 31 28 73

44 going to wait

44 done waiting

The data from matrix A received by process 45

87 61 85 3 21 48 99 36 92 64 46 87 91 42 59 86 21 47 70 96 30 59 100 29 16 16 51 6 17 99 19 66 39 79 23 1 35 91 52 5 23 50 13 78 21 25 20 98 29 33 68 13 47 82 24 85 88 79 30 81 31 63 11 23

45 going to wait

45 done waiting

The data from matrix A received by process 46

77 63 55 24 13 40 72 79 94 100 80 52 89 76 90 30 83 49 100 14 43 4 31 75 8 22 98 19 38 71 86 59 1 5 5 58 46 41 16 78 61 98 59 96 58 65 62 61 92 95 95 76 78 40 41 34 60 84 55 11 54 9 9 91

46 going to wait

46 done waiting

The data from matrix A received by process 47

96 45 39 5 26 76 63 54 100 43 39 6 92 26 16 71 14 91 21 22 45 72 95 58 44 95 9 94 24 31 14 26 24 14 26 76 44 62 18 52 67 24 80 27 19 99 27 100 54 72 17 85 66 18 61 7 40 1 39 18 58 95 81 68

47 going to wait

47 done waiting

The data from matrix A received by process 0

96 5 70 87 57 74 89 1 10 86 77 37 12 94 99 83 3 4 82 35 58 36 24 60 53 52 62 70 32 64 2 24 38 24 53 21 32 27 73 55 47 64 37 28 35 92 67 57 78 71 29 20 16 34 59 38 68 36 27 9 86 43 74 30

0 waited

The data recieved from vector b recieved by process 0

1

The data recieved from vector b recieved by process 3

4

The data recieved from vector b recieved by process 2

3

The data recieved from vector b recieved by process 4

5

The data recieved from vector b recieved by process 6

7

The data recieved from vector b recieved by process 8

9

The data recieved from vector b recieved by process 5

6

The data recieved from vector b recieved by process 1

2

The data recieved from vector b recieved by process 16

17

The data recieved from vector b recieved by process 17

18

The data recieved from vector b recieved by process 18
19
The data recieved from vector b recieved by process 19
20
The data recieved from vector b recieved by process 20
21
The data from matrix A received by process 22
62 37 78 51 30 40 5 5 30 100 12 92 90 71 76 65 91 44 62 30 23 64 77 54 39 10 81 23 89 46 2 43 3 8 69 99 80 82 9 42 94 87 20 17 72 16 57 89 96 46 85 9 35 98 5 10 8 70 79 65 14 49 50 91

22 going to wait
22 done waiting
The data recieved from vector b recieved by process 22
23
The data from matrix A received by process 23
18 60 99 27 41 70 46 71 14 33 97 72 26 10 27 4 11 71 52 96 98 66 32 39 17 13 97 20 61 68 77 47 24 7 20 31 21 4 2 22 98 75 19 53 98 77 11 66 93 6 21 12 21 5 39 85 66 73 36 54 56 12 48 30

23 going to wait
23 done waiting
The data recieved from vector b recieved by process 21
22
The data recieved from vector b recieved by process 23
24
The data recieved from vector b recieved by process 31
32
The data recieved from vector b recieved by process 27
28
The data recieved from vector b recieved by process 29
30
The data recieved from vector b recieved by process 30
31
The data from matrix A received by process 32
0 96 21 22 91 64 49 39 45 30 97 81 35 89 87 65 75 61 27 53 82 99 49 36 54 82 80 84 53 16 8 49 88 27 16 52 58 37 85 69 70 40 73 21 58 50 43 7 93 60 58 18 44 85 36 18 96 78 25 15 75 83 28 79

32 going to wait
32 done waiting
The data recieved from vector b recieved by process 32
33
The data recieved from vector b recieved by process 33
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The data recieved from vector b recieved by process 34
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The data recieved from vector b recieved by process 35

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The data recieved from vector b recieved by process 36
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The data recieved from vector b recieved by process 37
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The data recieved from vector b recieved by process 38
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The data recieved from vector b recieved by process 39
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The data recieved from vector b recieved by process 40
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The data recieved from vector b recieved by process 41
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The data recieved from vector b recieved by process 42
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The data recieved from vector b recieved by process 43
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The data recieved from vector b recieved by process 44
45
The data recieved from vector b recieved by process 45
46
The data recieved from vector b recieved by process 46
47
The data from matrix A received by process 48
34 26 13 60 26 86 45 11 2 50 81 14 67 62 23 49 69 68 99 43 98 71 62 70 12 39 65 77 1 27 90 81 23 51 50
92 59 74 27 100 25 14 19 99 60 26 93 45 29 21 92 86 98 87 79 94 73 61 20 11 62 60 36 94

48 going to wait
48 done waiting
The data recieved from vector b recieved by process 48
49
The data from matrix A received by process 49
69 42 65 84 99 52 40 14 40 99 9 26 26 38 49 80 88 64 92 18 53 30 83 55 17 42 72 66 16 93 11 26 34 43
59 92 67 85 53 77 68 4 76 52 21 87 58 7 80 80 34 81 14 63 71 26 53 44 96 40 2 32 96 61

49 going to wait
49 done waiting
The data recieved from vector b recieved by process 49
50
The data from matrix A received by process 50
28 13 40 53 13 73 90 41 7 48 48 44 69 93 81 5 59 11 99 69 35 24 63 6 78 45 77 72 62 47 63 75 77 2 55 78
90 52 30 55 10 40 64 14 26 47 34 82 24 43 39 49 67 83 66 24 62 46 6 79 99 83 7 9

50 going to wait
50 done waiting

The data recieved from vector b recieved by process 50

51

The data from matrix A received by process 51

88 76 92 28 82 61 82 58 10 8 100 19 13 79 92 43 22 57 77 70 26 81 84 34 67 67 16 92 17 20 13 31 53 56 17 69 6 46 42 90 22 28 78 26 16 51 51 82 55 49 49 23 96 98 7 54 27 48 78 83 20 74 24 99

51 going to wait

51 done waiting

The data recieved from vector b recieved by process 51

52

The data from matrix A received by process 52

75 50 31 19 76 49 92 80 41 4 23 16 89 100 100 62 2 71 60 44 88 45 16 63 36 48 41 5 44 96 9 39 12 18 13 70 74 23 15 87 49 51 2 79 14 30 87 36 91 23 94 17 21 44 54 2 61 81 89 88 53 44 91 2

52 going to wait

52 done waiting

The data recieved from vector b recieved by process 52

53

The data from matrix A received by process 53

67 39 13 56 46 52 9 67 41 10 20 53 45 13 79 86 34 64 70 99 4 77 46 6 58 77 53 75 51 76 19 1 92 47 91 63 70 91 67 36 60 41 96 17 60 61 5 55 27 72 85 97 82 5 51 3 58 89 98 83 34 21 65 10

53 going to wait

53 done waiting

The data recieved from vector b recieved by process 53

54

The data from matrix A received by process 54

24 28 12 83 24 66 72 71 100 56 16 32 45 53 48 16 10 73 74 92 67 20 43 86 83 56 35 14 66 43 60 32 77 55 84 86 18 71 97 43 36 19 76 65 79 74 17 67 12 83 50 10 67 85 26 42 32 4 81 7 48 9 57 64

54 going to wait

54 done waiting

The data recieved from vector b recieved by process 54

55

The data from matrix A received by process 55

20 88 54 58 95 39 37 53 28 81 81 100 74 8 80 38 3 8 29 94 59 34 26 83 85 11 23 18 70 61 99 100 1 70 75 58 63 38 17 96 80 15 7 98 9 15 56 85 8 3 70 57 81 1 56 85 10 7 30 12 97 5 23 23

55 going to wait

55 done waiting

The data recieved from vector b recieved by process 55

56

The data from matrix A received by process 56

85 70 10 27 94 72 12 28 49 14 37 62 94 51 93 59 68 7 69 97 74 95 94 53 52 78 70 68 22 50 52 85 50 5 96 16 96 80 27 1 5 51 100 8 8 11 97 72 33 17 36 85 11 24 68 86 73 60 22 38 3 80 39 27

56 going to wait

56 done waiting

The data recieved from vector b recieved by process 56

57

The data from matrix A received by process 57

94 13 41 85 5 75 86 60 37 61 91 64 92 64 61 96 9 81 16 73 63 32 70 8 18 79 6 59 34 42 88 88 27 87 96 42 25 70 8 80 13 27 19 3 84 10 72 3 14 35 96 57 97 70 75 12 47 77 83 74 2 26 98 100

57 going to wait

57 done waiting

The data recieved from vector b recieved by process 57

58

The data from matrix A received by process 58

75 2 85 8 60 15 66 29 18 52 64 76 61 89 3 22 18 98 38 78 51 88 19 9 37 20 53 39 98 86 21 92 80 92 41 10 11 30 91 72 18 25 13 44 59 9 25 77 36 80 10 24 60 76 99 47 46 22 24 55 44 19 7 51

58 going to wait

58 done waiting

The data recieved from vector b recieved by process 58

59

The data from matrix A received by process 59

36 7 68 24 12 73 40 100 99 26 94 13 18 46 92 22 99 39 89 89 88 23 31 31 16 88 10 68 95 17 53 29 82 84 13 3 28 2 92 33 55 15 45 37 75 51 20 71 93 92 58 83 3 92 22 28 34 73 70 5 35 16 58 70

59 going to wait

59 done waiting

The data recieved from vector b recieved by process 59

60

The data from matrix A received by process 60

74 47 97 78 60 46 16 88 4 44 71 12 64 5 14 99 77 70 7 93 69 81 73 34 39 23 30 63 84 51 68 15 16 8 80 25 70 73 8 4 73 48 27 44 55 32 70 47 67 95 33 84 50 56 3 6 53 96 62 92 26 28 59 31

60 going to wait

60 done waiting

The data recieved from vector b recieved by process 60

61

The data from matrix A received by process 61

28 94 29 97 56 51 51 53 9 48 34 87 46 20 7 10 23 74 10 99 42 23 29 95 11 45 80 83 77 21 64 83 82 22 20 61 12 84 54 4 38 56 91 5 39 32 70 16 89 66 82 58 5 20 86 81 33 38 97 41 53 43 71 94

61 going to wait

61 done waiting

The data recieved from vector b recieved by process 61

62

The data from matrix A received by process 62
62 65 38 25 100 83 16 80 39 32 4 40 29 30 26 21 93 16 69 93 67 91 3 73 18 95 43 44 2 10 27 84 68 9 71
46 79 57 62 73 68 92 17 46 84 80 100 42 8 92 98 85 88 50 32 5 52 59 82 54 37 5 100 65

62 going to wait
62 done waiting
The data recieved from vector b recieved by process 62
63
The data recieved from vector b recieved by process 47
48
The data recieved from vector b recieved by process 11
12
The data recieved from vector b recieved by process 10
11
The data recieved from vector b recieved by process 9
10
The data recieved from vector b recieved by process 7
8
The data recieved from vector b recieved by process 14
15
The data recieved from vector b recieved by process 12
13
The data recieved from vector b recieved by process 13
14
The data recieved from vector b recieved by process 15
16
The data from matrix A received by process 63
16 30 82 23 9 90 3 31 33 71 19 54 95 87 76 22 92 77 37 53 61 48 48 44 34 60 90 7 36 18 88 14 7 94 44 68
81 66 12 67 26 22 70 9 28 55 57 2 86 81 27 65 40 68 52 47 9 44 78 53 13 39 40 2

63 going to wait
63 done waiting
The data recieved from vector b recieved by process 63
64

Source

```c
1  #include<stdlib.h>
2  #include<stdio.h>
3  #include "mpi.h"
4
5
6  int main(int argc, char *argv[])
7  {
8    int N, npes;
9      int myrank;
10     int i, size, grp_size;
11     int* buf; /*receive buffer*/
12   int* vbuf;
13     int recv_count;
14     int myresult = 0;
15     int result;
16
17     MPI_Init(&argc,&argv);
18     MPI_Comm_size(MPI_COMM_WORLD, &npes);
19     MPI_Comm_size(MPI_COMM_WORLD, &grp_size);
20     MPI_Comm_rank(MPI_COMM_WORLD, &myrank); /* find rank */
21
22   N = npes;
23     int A[64][64];  /*data to be distribued from the root process*/
24   int b[64];
25
26     if(myrank == 0)
27     {
28     //open file and place it into 2d array
29     FILE *data;
30     data = fopen("Data2.csv", "r");
31     char currentChar = getc(data);
32     char str[] = "";
33     for(i=0;i<64; i++){
34       for(int j=0; j<64; j++){
35         A[i][j] = 0;
36         while(currentChar!=',' && currentChar!=EOF){
37           A[i][j] = 10 * A[i][j] + (currentChar - '0');
38           currentChar = getc(data);
39         }//end of searching for end of number
40         currentChar = getc(data);
41       }//end of filling current row
42     }//end of filling matrix
43
44     for(int i = 0; i < 64; i++){
45       b[i] = i + 1;
46     }//end filling vector b
47     }//end of initialization by P0
48
49     recv_count = 64*64/npes;
50     buf = (int* )malloc(recv_count*sizeof(int));
51   vbuf = (int* )malloc(recv_count*sizeof(int));
52
53   MPI_Scatter(A,recv_count,MPI_INT,buf,recv_count, MPI_INT,0,MPI_COMM_WORLD);
54
55     printf("The data from matrix A received by process %d\n", myrank);
56     for (i = 0; i<recv_count; i++)
57         printf("%d ", buf[i]);
58     printf("\n\n");
59
60   MPI_Request request;
61
62   if(myrank == 0){
63     int flag;
64     int tbuf;
65     MPI_Status status;
66     MPI_Irecv(&tbuf, 1, MPI_INT, MPI_ANY_TAG, 0, MPI_COMM_WORLD, &request);
67     MPI_Wait(&request, &status);
68     printf("%d waited\n", myrank);
69   }//P0 sent message to continue
70   if(myrank > 0){
```

```
71      int flag;
72      MPI_Status status;
73      MPI_Isend(&flag, 1, MPI_INT, 0, 0, MPI_COMM_WORLD, &request);
74      MPI_Test(&request, &flag, &status);
75      printf("%d going to wait\n", myrank);
76      while (!flag) {
77        MPI_Test(&request, &flag, &status);
78      }
79      printf("%d done waiting\n", myrank);
80    }//other proceses wait for P0
81
82    MPI_Scatter(b,64/npes,MPI_INT,vbuf,64/npes, MPI_INT,0,MPI_COMM_WORLD);
83
84    printf("The data recieved from vector b recieved by process %d\n", myrank);
85    for (size_t i = 0; i < 64/npes; i++) {
86      printf("%d ", vbuf[i]);
87    }//end of printing vector b
88    printf("\n");
89
90      MPI_Finalize();
91
92      return 0;
93  }//end main
```