

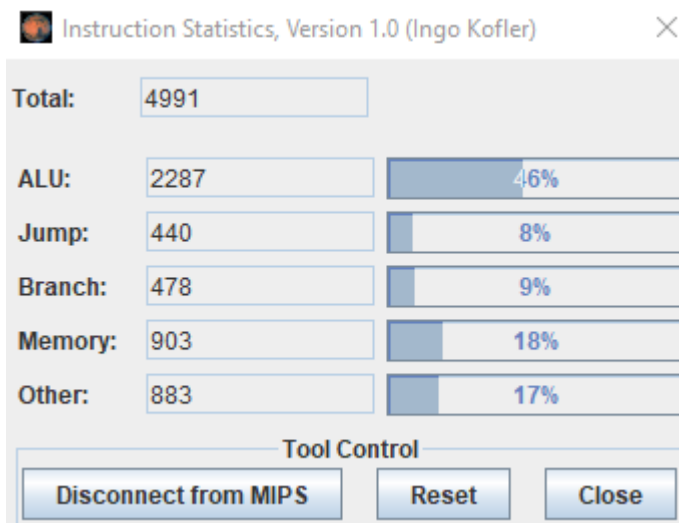
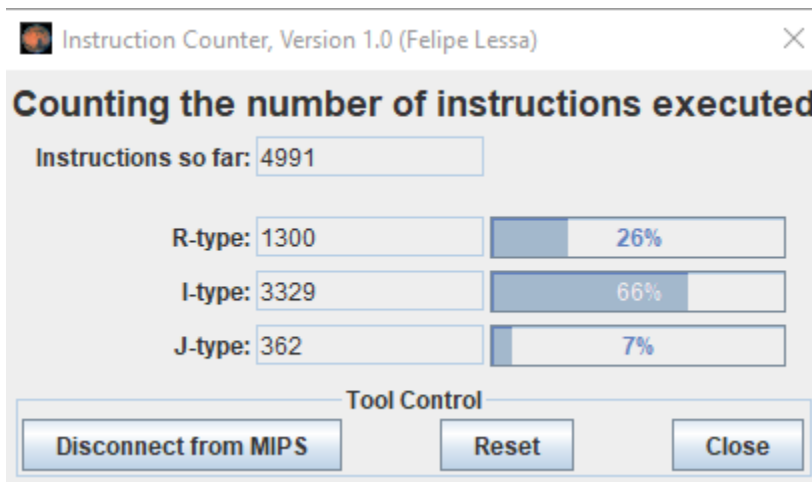
BÁO CÁO

BÀI TẬP LỚN KIẾN TRÚC MÁY TÍNH

Danh sách thành viên:

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Merge sort:



Test case 1:

```
Input array: 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
19 20
18 19 20
16 17
16 17 18 19 20
14 15
13 14 15
11 12
11 12 13 14 15
11 12 13 14 15 16 17 18 19 20
9 10
8 9 10
6 7
6 7 8 9 10
4 5
3 4 5
1 2
1 2 3 4 5
1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

-- program is finished running --
```

Test case 2:

```
Input array: 88 64 60 43 31 2 70 0 -8 -77 -90 -60 -76 -44 27 36 37 28 43 8
64 88
60 64 88
31 43
31 43 60 64 88
2 70
0 2 70
-77 -8
-77 -8 0 2 70
-77 -8 0 2 31 43 60 64 70 88
-90 -60
-90 -76 -60
-44 27
-90 -76 -60 -44 27
36 37
28 36 37
8 43
8 28 36 37 43
-90 -76 -60 -44 8 27 28 36 37 43
-90 -77 -76 -60 -44 -8 0 2 8 27 28 31 36 37 43 43 60 64 70 88

-- program is finished running --
```

Test case 3:

```

Input array: 19 -30 35 -5 67 -42 30 -16 50 -32 34 -7 88 -3 72 -14 68 -26 54 -5
-30 19
-30 19 35
-5 67
-30 -5 19 35 67
-42 30
-42 -16 30
-32 50
-42 -32 -16 30 50
-42 -32 -30 -16 -5 19 30 35 50 67
-7 34
-7 34 88
-3 72
-7 -3 34 72 88
-14 68
-26 -14 68
-5 54
-26 -14 -5 54 68
-26 -14 -7 -5 -3 34 54 68 72 88
-42 -32 -30 -26 -16 -14 -7 -5 -5 -3 19 30 34 35 50 54 67 68 72 88

-- program is finished running --

```

Test case 4:

```

Input array: 4019 25243 11238 -3306 -27236 -27354 3963 7551 -30186 -17066 527 -7159 11048 -30537 13435 27 38 0 -12740 -23586
4019 25243
4019 11238 25243
-27236 -3306
-27236 -3306 4019 11238 25243
-27354 3963
-27354 3963 7551
-30186 -17066
-30186 -27354 -17066 3963 7551
-30186 -27354 -27236 -17066 -3306 3963 4019 7551 11238 25243
-7159 527
-7159 527 11048
-30537 13435
-30537 -7159 527 11048 13435
27 38
0 27 38
-23586 -12740
-23586 -12740 0 27 38
-30537 -23586 -12740 -7159 0 27 38 527 11048 13435
-30537 -30186 -27354 -27236 -23586 -17066 -12740 -7159 -3306 0 27 38 527 3963 4019 7551 11048 11238 13435 25243

-- program is finished running --

```

Test case 5:

```

Input array: 6 2 4 4 4 0 -2 -6 -3 4 8 5 9 4 8 7 2 0 7 2
2 6
2 4 6
4 4
2 4 4 4 6
-2 0
-6 -2 0
-3 4
-6 -3 -2 0 4
-6 -3 -2 0 2 4 4 4 4 6
5 8
5 8 9
4 8
4 5 8 8 9
2 7
0 2 7
2 7
0 2 2 7 7
0 2 2 4 5 7 7 8 8 9
-6 -3 -2 0 0 2 2 2 4 4 4 4 4 5 6 7 7 8 8 9

```

Test case 6:

```

Input array: 9 -18 92 92 27 -50 -12 46 97 93 -70 -18 -72 83 87 0 0 0 90 -25
-18 9
-18 9 92
27 92
-18 9 27 92 92
-50 -12
-50 -12 46
93 97
-50 -12 46 93 97
-50 -18 -12 9 27 46 92 92 93 97
-70 -18
-72 -70 -18
83 87
-72 -70 -18 83 87
0 0
0 0 0
-25 90
-25 0 0 0 90
-72 -70 -25 -18 0 0 0 83 87 90
-72 -70 -50 -25 -18 -18 -12 0 0 0 9 27 46 83 87 90 92 92 93 97

-- program is finished running --

```

Test case 7:

```
Input array: 22 50 -87 44 83 -55 -47 -16 45 87 48 -34 -67 85 48 -37 -66 75 1 14
22 50
-87 22 50
44 83
-87 22 44 50 83
-55 -47
-55 -47 -16
45 87
-55 -47 -16 45 87
-87 -55 -47 -16 22 44 45 50 83 87
-34 48
-67 -34 48
48 85
-67 -34 48 48 85
-66 -37
-66 -37 75
1 14
-66 -37 1 14 75
-67 -66 -37 -34 1 14 48 48 75 85
-87 -67 -66 -55 -47 -37 -34 -16 1 14 22 44 45 48 48 50 75 83 85 87

-- program is finished running --
```

Test case 8:

```
Input array: 19 -31 12 22 -53 90 -29 -97 -41 -8 -5 -15 -9 -30 51 75 60 -82 60 78
-31 19
-31 12 19
-53 22
-53 -31 12 19 22
-29 90
-97 -29 90
-41 -8
-97 -41 -29 -8 90
-97 -53 -41 -31 -29 -8 12 19 22 90
-15 -5
-15 -9 -5
-30 51
-30 -15 -9 -5 51
60 75
-82 60 75
60 78
-82 60 60 75 78
-82 -30 -15 -9 -5 51 60 60 75 78
-97 -82 -53 -41 -31 -30 -29 -15 -9 -8 -5 12 19 22 51 60 60 75 78 90

-- program is finished running --
```

Test case 9:

```
Input array: -780 -6 182 847 416 59 -643 994 -864 435 -954 667 551 830 409 457 -135 527 539 -52
-780 -6
-780 -6 182
416 847
-780 -6 182 416 847
-643 59
-643 59 994
-864 435
-864 -643 59 435 994
-864 -780 -643 -6 59 182 416 435 847 994
-954 667
-954 551 667
409 830
-954 409 551 667 830
-135 457
-135 457 527
-52 539
-135 -52 457 527 539
-954 -135 -52 409 457 527 539 551 667 830
-954 -864 -780 -643 -135 -52 -6 59 182 409 416 435 457 527 539 551 667 830 847 994
```

Test case 10:

```
Input array: 22 70202 -7 -84 -84 29 86 90 56 18 96 48 -54 -69 -46 -28 50 -3101 52 20 52
22 70202
-7 22 70202
-84 -84
-84 -84 -7 22 70202
29 86
29 86 90
18 56
18 29 56 86 90
-84 -84 -7 18 22 29 56 86 90 70202
48 96
-54 48 96
-69 -46
-69 -54 -46 48 96
-28 50
-3101 -28 50
20 52
-3101 -28 20 50 52
-3101 -69 -54 -46 -28 20 48 50 52 96
-3101 -84 -84 -69 -54 -46 -28 -7 18 20 22 29 48 50 52 56 86 90 96 70202

-- program is finished running --
```

Execution time of test case 1:

$$\text{Execution time} = \frac{IC \times CPI}{\text{Frequency}} = \frac{4991 \times 1}{2 \times 10^9} = 2.4955 \mu s$$

