



**Yıldız Technical University**  
**Computer Engineering**  
**2023-2024 Spring**  
**BLM2022 Computer Organization**  
**Homework 3**

**Question 1)**

You are given an array of twenty 32-bit different positive integers (ARR), and another array (COUNT) of twenty elements each has the number of cells that are greater than the corresponding element of array ARR. You are asked to write a RISC-V assembly code that sorts array ARR in array RESULT, in an descending order, in  $O(n)$  complexity. You can only use the implemented assembly instructions on architecture from HW2.

You should initialize arrays ARR, COUNT and RESULT accordingly and use it in your tests.

Having the machine code for your assembly code load it to architecture from Homework 2, run it and show your results.

Test:

|       |    |    |    |    |    |    |    |      |     |    |    |     |    |    |    |     |      |     |    |    |
|-------|----|----|----|----|----|----|----|------|-----|----|----|-----|----|----|----|-----|------|-----|----|----|
| ARR   | 3  | 7  | 2  | 6  | 5  | 4  | 1  | 1000 | 999 | 25 | 90 | 100 | 30 | 20 | 10 | 200 | 3300 | 250 | 12 | 75 |
| COUNT | 17 | 13 | 18 | 14 | 15 | 16 | 19 | 1    | 2   | 9  | 6  | 5   | 8  | 10 | 12 | 4   | 0    | 3   | 11 | 7  |

Result:

|        |      |      |     |     |     |     |    |    |    |    |    |    |    |   |   |   |   |   |   |   |
|--------|------|------|-----|-----|-----|-----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|
| RESULT | 3300 | 1000 | 999 | 250 | 200 | 100 | 90 | 75 | 30 | 25 | 20 | 12 | 10 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|--------|------|------|-----|-----|-----|-----|----|----|----|----|----|----|----|---|---|---|---|---|---|---|

Note: Turn in your answers as [StudentNo].zip file structured as follows with a maximum of 5-minute video ([StudentNo].mkv) explaining your design and testbench ([StudentNo].v, [StudentNo]\_tb.v, [StudentNo].vcd) results. Grading:

| CODE/RESULTS/FILE  |          |
|--|----------|
| Description  | Penalty  |
| RISC-V assembly instructions sets used other than from HW2   | -15      |
| Code compilation error   | -30      |
| Not sorting in descending order  | -10      |
| $O(n)$ complexity criterion was not met  | -20      |
| For each file; incorrect file naming and missing files inside the [StudentNo].zip (Required files: [StudentNo].v, [StudentNo]_tb.v, [StudentNo].vcd) | -5       |
| Incorrect sorting/result   | -50      |
| VIDEO  |          |
| Description  | Penalty  |
| Missing video (video sound should be sufficiently clear and not sped up)   | -50      |
| Video exceeds 5 minutes, penalized for each additional minute (additional 30 seconds is an acceptable margin)  | -5       |
| Test results were not shown on GTKWave   | -25      |
| Insufficient explanation of the method/code  | 0 to -25 |