**HW#6 (CSC390); Turn in your HW on the Blackboard by** 03/13/2018 by 11:30PM

**#Q1.** Consider the following two C procedures (swap and sort) and their corresponding MIPS assembly codes as shown in the figures 1 and 2, respectively. Using these two C procedures (swap and sort) write a MIPS assembly program that will sort the following array elements in the **ascending order**. What changes would you make to sort the array elements in **descending order**?

**Array= [100 50 75 -1 -50 500 20 40 40 17 19 23 5 7 -20]**

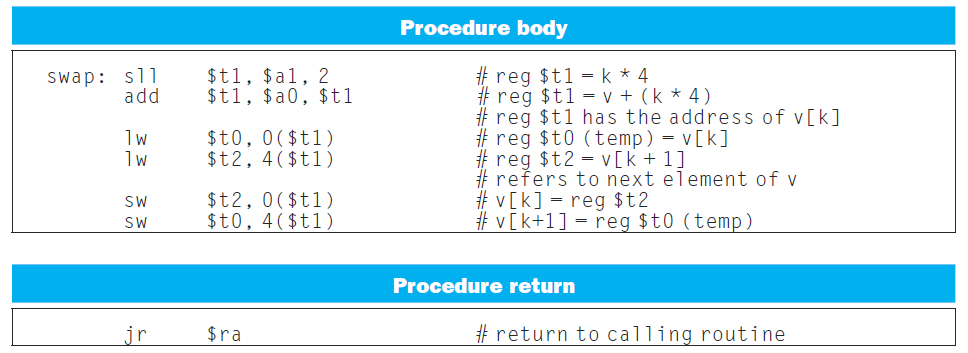
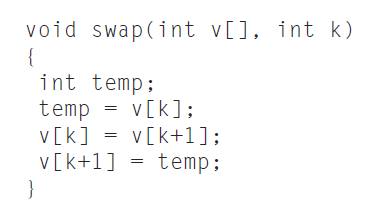
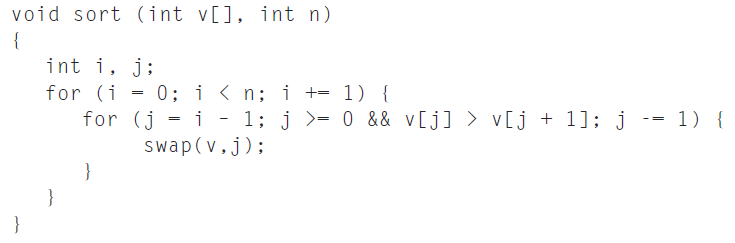


Figure 1 MIPS assembly code for swap procedure



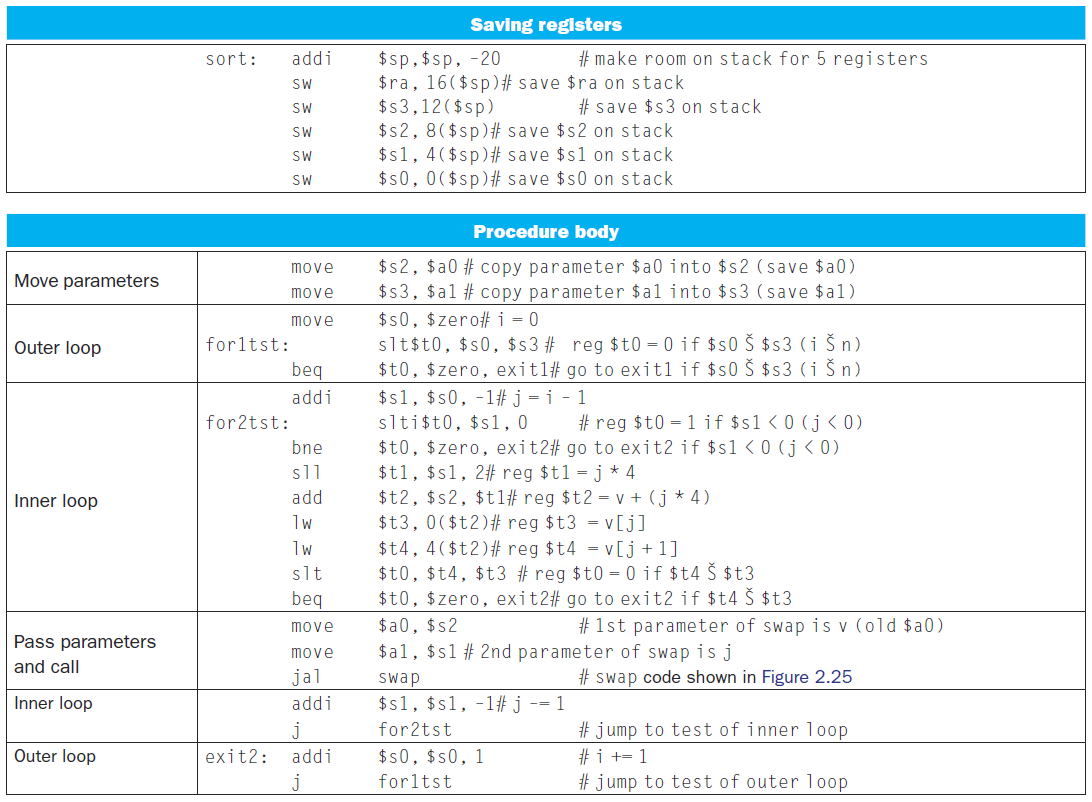
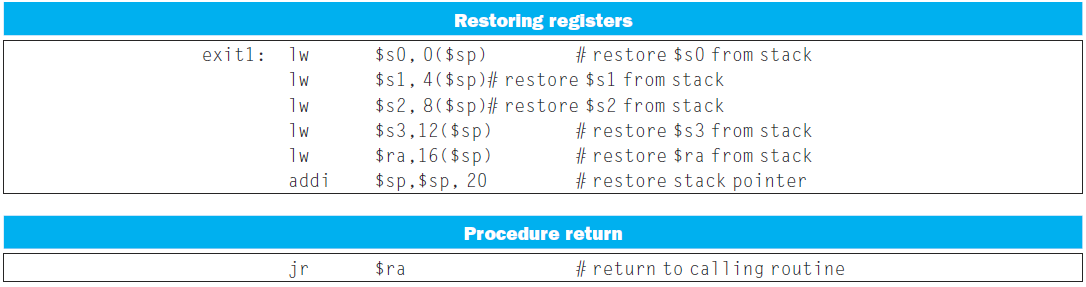
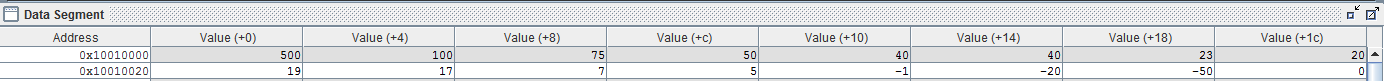
 

Figure 2 MIPS assembly version of sort procedure

Results (ascending order) :



Results (descending order) :



**Q2.** Given the two object files of procedure A and procedure B, show updated address of the first few instructions of the completed executable file. Ref: pages 127-128 of your text book.

Note that the default starting address of Text segment = 0x00400000hex, Data Segment = 0x10000000hex and $gp = 0x10008000hex

|  |  |  |  |
| --- | --- | --- | --- |
| **Object File Header** |  |  |  |
|  | Name | Procedure A |  |
| Text Size | 120hex |  |
| Data Size | 30hex |  |
| Text Segment | Address | Instruction |  |
|  | 0 | lw $a0, **O1**($gp) |  |
| 4 | lw $a1, **O2**($gp) |  |
| 8 | jal **O** |  |
| …. |  |  |
| Data Segment | **O1** | (X1) |  |
|  | **O2** | (X2) |  |
| …. | …. |  |
| Relocation Table | Label | Address | Dependency |
|  | 0 | lw | X1 |
| 4 | lw | X2 |
| 8 | jal | B |
| Symbol Table | Label | Address |  |
|  | X1 | -- |  |
| X2 | -- |  |
| B | -- |  |
| **Object File Header** |  |  |  |
|  | Name | Procedure B |  |
| Text Size | 250hex |  |
| Data Size | 25hex |  |
| Text Segment | Address | Instruction |  |
|  | 0 | lw $a0, **O1**($gp) |  |
| 8 | jal **O** |  |
| 4 | sw $a1, **O2**($gp) |  |
| …. |  |  |
| Data Segment | **O1** | (Y1) |  |
|  | **O2** | (Y2) |  |
| …. | …. |  |
| Relocation Table | Label | Address | Dependency |
|  | 0 | lw | Y1 |
| 4 | jal | A |
| 8 | sw | Y2 |
| Symbol Table | Label | Address |  |
|  | Y1 | -- |  |
| A | -- |  |
| Y2 | -- |  |

**Table 1 Object files of Procedure A and Procedure B**