Computer Architecture
Homework Assignment 3

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In C we have the general sorting function **`qsort`** that implements the quick-sort algorithm. The C library description describes it as

```
void qsort(void *base, size_t nitems, size_t size, int (*compare)
(const void *, const void*))
```

It is a function that receives as arguments
- A pointer to the array of elements (of undetermined type): **`base`**
- An int of the number of items in the array: **`nitems`**
- The size of one element in the array: **`size`**
- A pointer to a function that compares two elements (specified by two general pointers) and returns an int: **`compare`**

In turn this comparing function must obey this requisite:
- recieves two pointers to elements
- returns an int specifying which element is 'larger'.

As an example, where the array to be sorted is an array of int:

```
#include <stdio.h>
#include <stdlib.h>

// Comparison function
int compare(const void* a, const void* b) {
   return (*(int*)a - *(int*)b);
}

int main() {
   int arr[] = {10, 5, 4, 6, 9};
   int n = sizeof(arr) / sizeof(arr[0]);

   qsort(arr, n, sizeof(int), compare);

   printf("Following is the sorted array: ");
```

```
    int i;
    for (i = 0; i < n; ++i) {
        printf("%d ", arr[i]);
    }
    printf("\n");
    return 0;
}
```

Which has output:

```
Following is the sorted array: 4 5 6 9 10
```

We are going to do the same, but instead of **`qsort`** we will use **`bsort`**, namely bubble-sort. The algorithm for bubble-sort is the following:

bsort algorithm:

- Set the flag **`change`** to **`false`**,
- In a for-loop from **`i=0`** to **`n-2`**, check if **`element[i]>element[i+1]`**, if so exchange them and raise the flag **`change`** to **`true`** that indicates a change has taken place in this iteration,
- Repeat until **`change`** is **`false`**.

Write a MIPS Assembly program that implements a **single function** **`bsort`** and tests it with an array of **`int`** and an array of **`float`**.

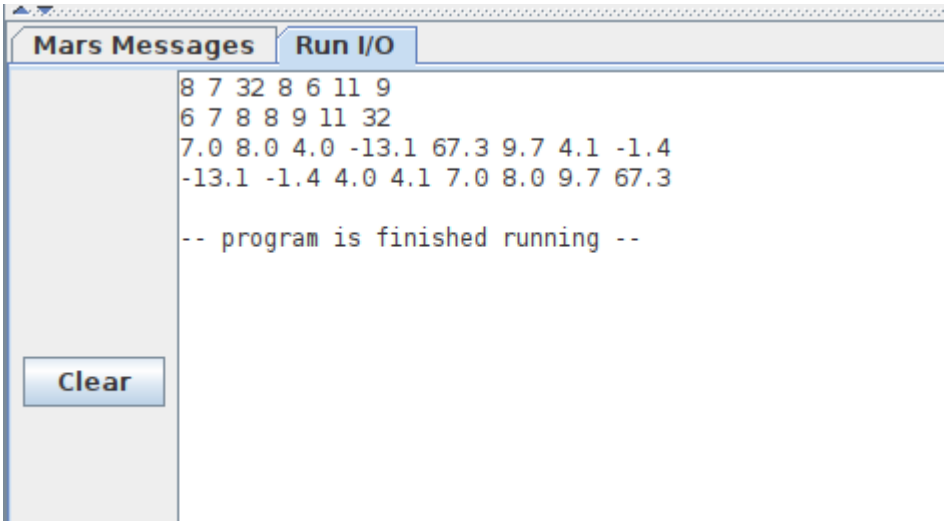
Arrays to use:

```
.data

myintsarray: .word 8 7 32 8 6 11 9
myfloatsarray: .float 7.0 8.0 4.0 -13.1 67.3 9.7 4.1 -1.4
```

`bsort`, like **`qsort`**, receives these arguments:

- A pointer to the array of elements (of undetermined type)
- An int of the number of items in the array
- An int specifying the size of one element in the array
- A pointer to a function that compares two elements



- It is probably a good idea to first write the program in C.
- The functions as well as main must use at least one $t and one $s register.
- Groups of one (1) or two (2) people.
- Hand in one (1) file (`aXXXXXaYYYYY.asm`) at the Tutoria Electronica. (Not needed for both members of the group to hand in a file. One suffices).
- Deadline: **18 maio 2025, 21h00** (Lisbon time).
- Write your names (2) as a comment in the first line of the file.