Computer Systems and -architecture

MIPS: 2nd Session

1 Ba INF 2011-2012

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Time Schedule

Exercises are made individually. Fill in all solutions to the exercises in the file `oefeningen.html`. **Include all .asm files that contain your MIPS programs.**

Put all your files in a tgz archive, as explained on the course's website, and submit your solution to the exercises on Blackboard.

- Deadline: **August, 19 2012, 23u55**

Exercises

Write a MIPS program for the MARS simulator for each of the following exercises. As always, document your solution well (use #).

1. (a) Write a MIPS program that reads an integer n (using a syscall), after which it reads n integers (using syscalls), and stores them in an array. Because you don't know the size of the array in advance, you will have to allocate space for it on the heap (*Hint: use syscall 9 for* `sbrk`).

   (b) Add a (leaf) procedure that prints an array. The procedure has two parameters: the address of the first element of the array and the number of elements in the array. Call the procedure with the array on the heap.

(c) Add a (leaf) procedure that sorts an array. Call the procedure with the array on the heap. Implement the algorithm from the C++ function below.

```
void sort(int array[], int arrayLength)
{
   int nrOfSwaps;
   do {
      nrOfSwaps = 0;
      for(int i = 0; i < arrayLength - 1; i++) {
         if( a[i] > a[i + 1] ) {
            int temp = a[i];
            a[i] = a[i + 1];
            a[i + 1] = temp;
            nrOfSwaps++;
         }
      }
   }
   while(nrOfSwaps > 0);
}
```

2. Write a MIPS program that reads two integers a and b, and calculates the greatest common divisor.

   - Write a (leaf) `remainder` procedure that takes two arguments a and b, and calculates the remainder of the division of a and b.
   - Write a (recursive) procedure `gcd` with two arguments a and b, which calculates the greatest common divisor using this recursive definition:

$$gcd(x, y) = \begin{cases} x & : \text{ if } y = 0 \\ gcd(y, remainder(x, y)) & : \ x \geq y \text{ and } y > 0 \end{cases} \quad (1)$$