Test Bench for 32-bit Processor

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November 13, 2023

1 Introduction

In this document, we analyze two fundamental algorithms as implemented in assembly language: the Bubble Sort and the Greatest Common Divisor (GCD) calculation.

2 Bubble Sort Algorithm (sort.s)

- Initialize all required registers to zero.
- Load the first number into a register (e.g., 63 into register $2).
- Load the second number into another register (e.g., 8 into register $3).
- Copy these numbers into separate registers for manipulation.
- Enter a loop where:
  - If any register reaches zero, exit the loop as the GCD is found in the other register.
  - Subtract the smaller number from the larger number.
  - Update the registers with the new values.
  - Repeat the process until the two numbers become equal.
- The final value is in register $1 the GCD of the original numbers.

3 GCD Calculation (gcd.s)

- Initialize necessary registers to zero.
- Sequentially load a set of numbers into memory, using a register to store each number and another register as the base address for memory storage.
- Initialize loop counters for the sorting process.

- Begin the outer loop, loading each element from the memory for comparison.
- In the inner loop, compare adjacent elements.
  - If they are in the wrong order, swap them.
  - Update the loop counters and memory pointers accordingly.
- Repeat the comparison and swapping process for the entire array until the array is sorted.
- Retrieve the sorted array from memory.

4 Conclusion

In this report, we have delved into the intricacies of two fundamental algorithms implemented in assembly language: the Greatest Common Divisor (GCD) and the Bubble Sort algorithm. The GCD algorithm showcased a methodical approach to problem-solving using basic arithmetic operations, highlighting the efficiency and simplicity of assembly language in executing such tasks. Meanwhile, the Bubble Sort algorithm provided insight into data organization and manipulation at a low level, illustrating the foundational principles of sorting in computer science.