

## Assignment #2 Memory

24 November 2015

**This is an individual assignment and will contribute 10% of your final mark for CS1021.**

You must submit your solutions using Blackboard no later than 23:59 on Friday 18<sup>th</sup> December 2015. Late submissions without a satisfactory explanation will receive zero marks. You will not be asked to demonstrate your solution, however, you should expect someone grading your programs to execute them. It will be assumed that programs that do not build without errors do not work.

Submit your .s assembly language source files and your report **in PDF format** as attachments to "Assignment #2" in Blackboard.

**Your .s assembly language source files must be suitably commented.**

**Solutions will be checked for plagiarism.**

### 1 Sets – Symmetric Difference

Assume two mathematical *sets*, *A* and *B*, containing 32-bit unsigned integers are stored in memory. The following ARM Assembler directives illustrate how the sets are arranged.

1	ASize	DCD 8		; Number of elements in Set A
2	AElems	DCD 4,6,2,13,19,7,1,3		; Elements in Set A
3				
4	BSize	DCD 6		; Number of elements in Set B
5	BElems	DCD 13,9,1,20,5,8		; Elements in Set B

Design and write an ARM Assembly Language program that will create a third set, *C*, that is the *symmetric difference* of *A* and *B*.

Use the **Sets**  $\mu$ Vision project to develop your solution. Your program should store the size and elements of set *C* in memory using the memory set aside in the template project.

### 2 Countdown Checker

In the TV show "Countdown", contestants form words using nine randomly chosen letters. Each of the nine letters may only be used once. So, to form a word such as "beets", the nine letters must include at least one "b", two "e"s, one "t" and one "s".

Design and write an ARM Assembly Language program to determine if one string, *A*, can be formed from the nine letters contained in a second string, *B*.

Use the **Countdown**  $\mu$ Vision project to develop your solution. The template code in the project stores the start address of string *A* in R1 and the start address of string *B* in R2. Your program should store 1 in R0 if the word in *A* can be formed from the letters in *B* and zero otherwise.

### 3 Lottery

The *Imaginary Lottery Company* sells lottery tickets for a weekly draw. Players choose six numbers between 1 and 32 when purchasing an *Imaginary Lottery* ticket. There are prizes for matching four, five or six numbers.

Design and write an ARM Assembly Language program that will determine the number of tickets that match four numbers, five numbers and six numbers. (i.e. Your program should produce three result values for the number of “match four” tickets, “match five” tickets and “match six” tickets.)

Use the **Lotto**  $\mu$ Vision project to develop your solution. The numbers chosen for each ticket are stored consecutively in memory, beginning at the address labelled TICKETS. The number of tickets sold is stored in memory at the address labelled COUNT. The lottery numbers drawn are stored in memory at the address labelled DRAW. All lottery numbers are stored as simple byte-size values (i.e. they are not ASCII characters).

Your program should store its results in the three word-size memory locations, labelled MATCH4, MATCH5 and MATCH6.

### Evaluation

The following broad marking scheme will be used for the assignment:

- Sets – 25%
- Anagrams – 25%
- Lotto – 25%
- Documentation – 25%

Note that marks will be awarded for both the content and presentation of your report document. Solutions that are merely working will not automatically attract 100% of the marks available. Marks will also be awarded for the quality of the solution.