

# Computer Systems Architecture 2022/23

## Laboratory Exercise Preparation

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### 1. Introduction

In the Computer Systems Architecture laboratory exercise you will write a C program to simulate the operation of a cache controller on an embedded system.

To help you prepare for the two 3-hour laboratory sessions, it is recommended that you complete the following preparatory exercises.

All your programs must be written using ANSI standard C.

### 2. Reading memory trace files

The laboratory exercise will require you to read memory trace files. The memory trace files are ASCII text files. Each line begins with an 'R' or 'W' character to signify a memory read or memory write respectively. The 'R' or 'W' character is followed by a single space, and the memory address accessed. The address is represented as a hexadecimal number.

Write a C program to read a memory trace file, and to display the following information:

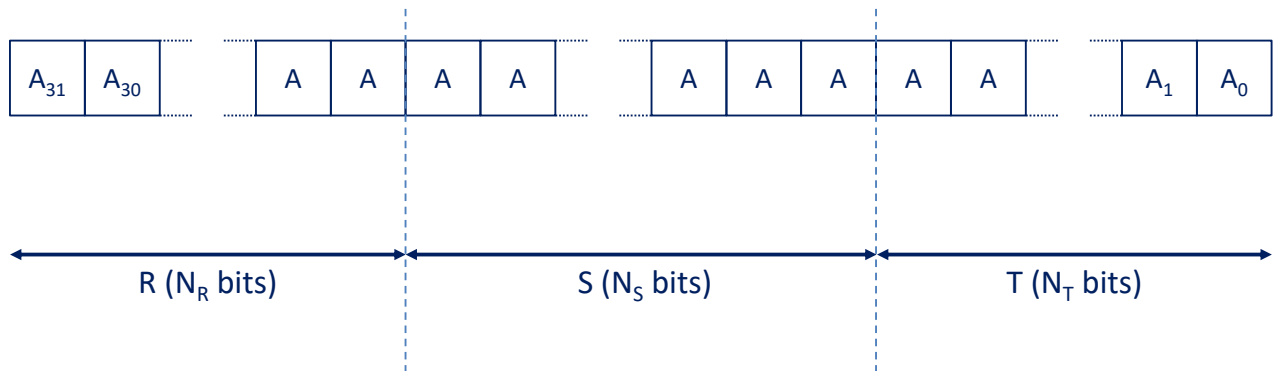
- The total number of read and write accesses
- The lowest and highest memory address accessed

A small test trace file, *test\_trace.trc*, has been provided to help you test your trace file read program. You can always create your own trace files.

### 3. Extracting bit fields

The laboratory exercise will require you to extract individual bit field values from an unsigned integer variable.

The figure below shows how three unsigned integer bit fields, R, S and T, can be stored in a 32-bit unsigned integer variable.



Write a C program to extract the three bit field values,  $R$ ,  $S$  and  $T$ , from a 32-bit unsigned integer variable. Initially, assume that  $N_R = 20$ ,  $N_S = 8$  and  $N_T = 4$ , but go on to test your program with other bit field widths.

You are recommended to use the C language bitwise operators to extract the bit fields.