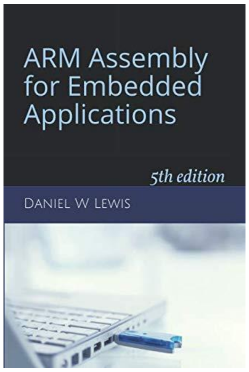


Programming Lab 4A

Copying Data Quickly

Click to download Lab4A-Main.c

Topics: Load and store instructions, unrolling loops, the .REPT directive, comparing execution times.

Prerequisite Reading: Chapters 1-4
Revised: June 22, 2021

Assignment: The main program will compile and run without writing any assembly. However, your task is to create equivalent replacements in assembly language for the following five functions found in the C main program. Each function copies 512 bytes of data from one array to another. The original C versions have been defined as "weak" so that the linker will automatically replace them in the executable image by those you create in assembly; you do not need to remove the C versions. This allows you to create and test your assembly language functions one at a time.

Each function should use the `.REPT` and `.ENDR` directives shown in Listing 4-1 to copy the data without a loop using a straight-line sequence of instructions. The main program will display the relative execution time of the three functions.

`void UseLDRB(void *dst, void *src)`

> Copy 1 byte at a time using `LDRB` and `STRB`, and optimize the execution time by updating the address using the Post-Indexed addressing mode shown in Table 4-6.

`void UseLDRH(void *dst, void *src)`

> Copy 2 bytes at a time using `LDRH` and `STRH`, and optimize the execution time by updating the address using the Post-Indexed addressing mode shown in Table 4-6.

`void UseLDR(void *dst, void *src)`

> Copy 4 bytes at a time using `LDR` and `STR`, and optimize the execution time by updating the address using the Post-Indexed addressing mode shown in Table 4-6.

`void UseLDRD(void *dst, void *src)`

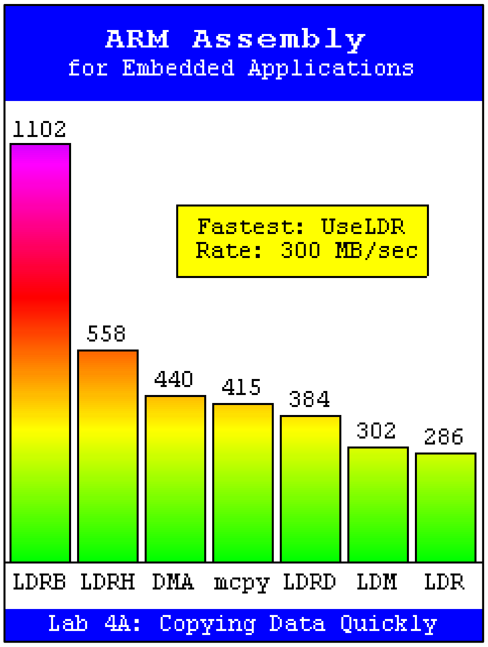
> Copy 8 bytes at a time using `LDRD` and `STRD`, and optimize the execution time by updating the address using the Post-Indexed addressing mode shown in Table 4-6.

`void UseLDM(void *dst, void *src)`

> Copy 32 bytes at a time using `LDMIA` and `STMIA`, and optimize the execution time by updating the address using the write-back flag (!) shown in Table 4-7.

If your code is correct, the display should look similar to the image at right with each function's execution time shown in clock cycles at the top of each bar graph. (Your numbers may differ, and the bar graph of an incorrect copy will be displayed in solid red.)

The bar graph labeled "mcpy" shows the clock cycle count for the library function `memcpy`, and the graph labeled "DMA" is the clock cycle count for a function provided in the main program that uses direct memory access. Note that once initialized by software, DMA transfers have the advantage of being independent of instruction execution so that both can continue concurrently.



```
Fastest: UseLDR
Rate: 300 MB/sec
```