

COL216 Computer Architecture

Lab Assignments 8

These assignments aim at extending the set of DP instructions in the CPU design of the previous assignment.

CPU with all ARM DP instructions

The previous design includes only 4 DP instructions – {add, sub, cmp, mov}. This subset is extended to include all 16 DP instructions - {and, eor, orr, bic, add, sub, adc, sbc, rsb, rsc, cmp, cmn, tst, teq, mov, mvn}. Secondly, the previous design considered the second operand of these instructions without any shift or rotate. In this assignment these features are to be included, excluding the special cases (see slide 13 of lecture 11). Thirdly, we include all 4 flags in the design now and depending upon the S-bit of the instruction, allow these flags to be updated appropriately.

From design point of view, the following changes need to be made to the previous design.

- Extend the ALU to carry out all the required functions, not only add and subtract.
- Design a shift rotate unit. This will also be a combinational circuit, designed as a separate entity/architecture.
- Decide whether shift/rotate is to be done in a separate cycle (define an additional control state, if that is the case) or clubbed with an existing cycle.
- Include logic for checking S-bit and updating flags if required. This may be done in the same cycle in which arithmetic / logical operation is done by ALU. Note that carry value can come from ALU or shifter, depending upon the instruction.