# CS120B – Homework #2

Given August 12, 2002. Due August 19, 2002 at the beginning of class.

Use the datapath and functional operations shown in Figure 1 below to implement the following algorithm:

Input a number n and output the factorial of n, i.e. $n!$ Assume that n is small and no overflow error results from the calculations.

You need to do the following:
a) Write the high-level pseudo-code to implement the algorithm.   (2)
b) Convert the pseudo-code to control words.   (2)
c) Draw the state-diagram for the control words.   (2)
d) Derive the next-state table.   (2)
e) Derive the next-state equations.   (2)
f) Derive the output equations.   (2)
g) Draw the complete FSM circuit.   (2)
h) Draw the circuit(s) that generates signals from the datapath for the FSM.   (2)
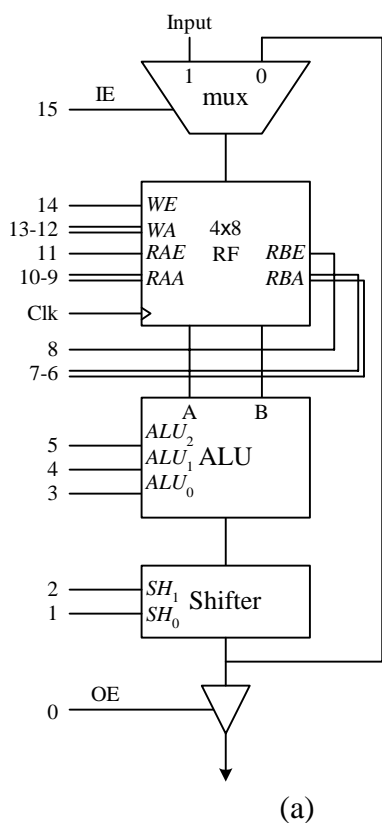
ALU_2	ALU_1	ALU_0	Operation
0	0	0	Pass through A
0	0	1	A AND B
0	1	0	A OR B
0	1	1	NOT A
1	0	0	$A + B$
1	0	1	$A - B$
1	1	0	$A + 1$
1	1	1	$A - 1$

(b)

SH_1	SH_0	Operation
0	0	Pass through
0	1	Shift left
1	0	Shift right
1	1	Rotate right

(c)

(a)

Figure 1. 8-bit datapath with register file: (a) circuit; (b) ALU operations; (c) Shifter operations.