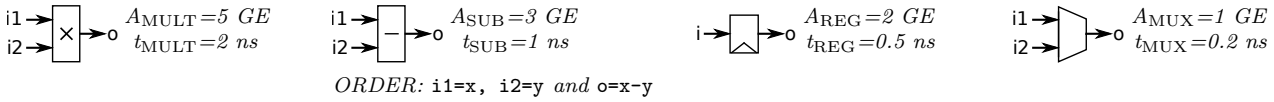
Essentials of Computer Systems - Exercises #2

1 Datapath Design - part 1

Exercise 1.1 *Datapath design:*

(a) Design a datapath (draw a DFD) with the following functionality: $z = 3(b - a) - ac + a$. The building blocks available are a multiplier and a subtracter, shown in figure below. You are given an area constraint: you are allowed to use at most 1 multiplier and at most one subtracter.



ORDER: `i1=x, i2=y` *and* `o=x-y`

(b) Fill out the analysis table for the DFD obtained in part (a) ignoring MUXes:

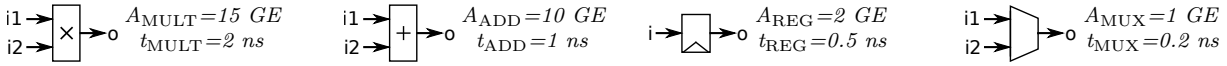
Analysis table	
latency	
throughput	
critical path delay	
clock period	
# inputs	
# outputs	
# registers	
# subtracters	
# multipliers	
total area in GE	

(c) Fill out the analysis table for the DFD obtained in part (a) including MUXes:

Analysis table	
latency	
throughput	
critical path delay	
clock period	
# inputs	
# outputs	
# registers	
# multiplexers	
# subtracters	
# multipliers	
total area in GE	

Exercise 1.2 *Datapath design:*

(a) Design a datapath (draw a DFD) with the following functionality: $z = a(a + b) - (bc + a)$. The building blocks available are a multiplier and an adder, shown in figure below. All inputs are available only in the first clock cycle. The top priority is to minimize the area.



(b) Fill out the analysis table for the DFD obtained in part (a):

Analysis table	
latency	
throughput	
critical path delay	
clock period	
# inputs	
# outputs	
# registers	
# multiplexers	
# adders	
# multipliers	
total area in GE	

(c) Draw the circuit for the DFD obtained in part (a):