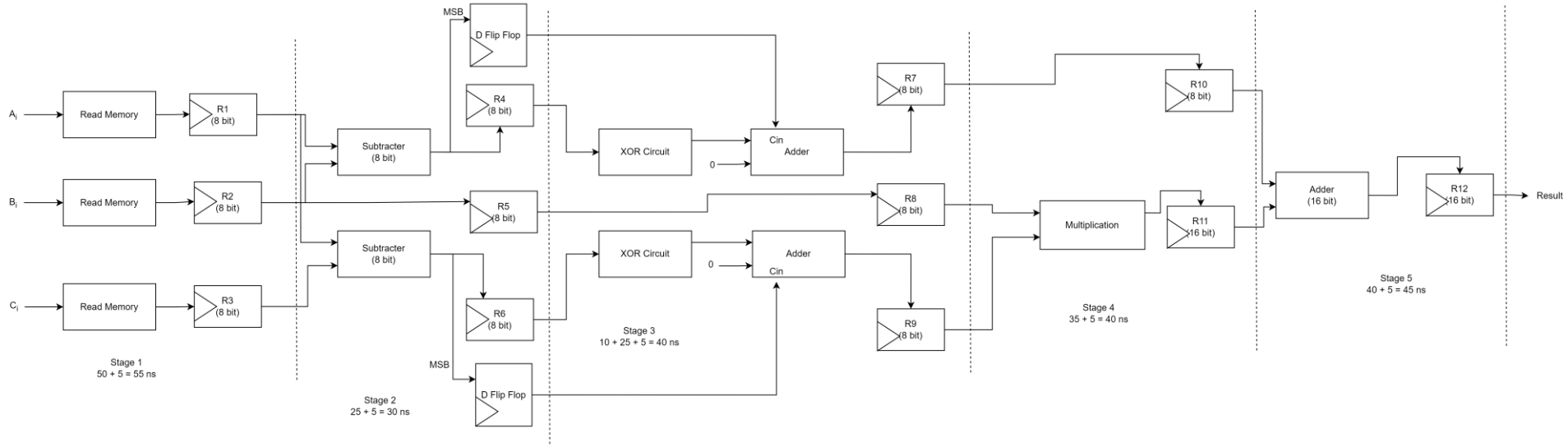
Homework 1 Solution

a)



b) The cycle time is determined according to the slowest stage of the pipeline. Accordingly,

t_p = 15 + 25 + 10 + 5 = **55 ns**

c) 5 cycles are needed to complete the execution of the first task. Since t_P=55 ns,T(1) =5*55 = **275 ns.**

d) t_n = 50 ns (memory access) + 25 ns (8 bit subtracter) + 10 ns (XOR) + 25 ns (8 bit adder) + 35 ns (Multiplication) + 40 ns (16 bit adder) = 185 ns

i. n→∞, $S = \frac{\mathrm{n} * \mathrm{tn}}{(\mathrm{k+n-1})*\mathrm{tp}} = \frac{tn}{tp}$ = 185/55 = **3.36**

ii. n→5, $S = \frac{\mathrm{n} * \mathrm{tn}}{(\mathrm{k+n-1})*\mathrm{tp}} = \frac{5*185}{(4+5-1)*55}$ = **2.10**

e) The theoretical maximum speedup is equal to the stage number of the pipeline. Accordingly, S_{max}=**5**.