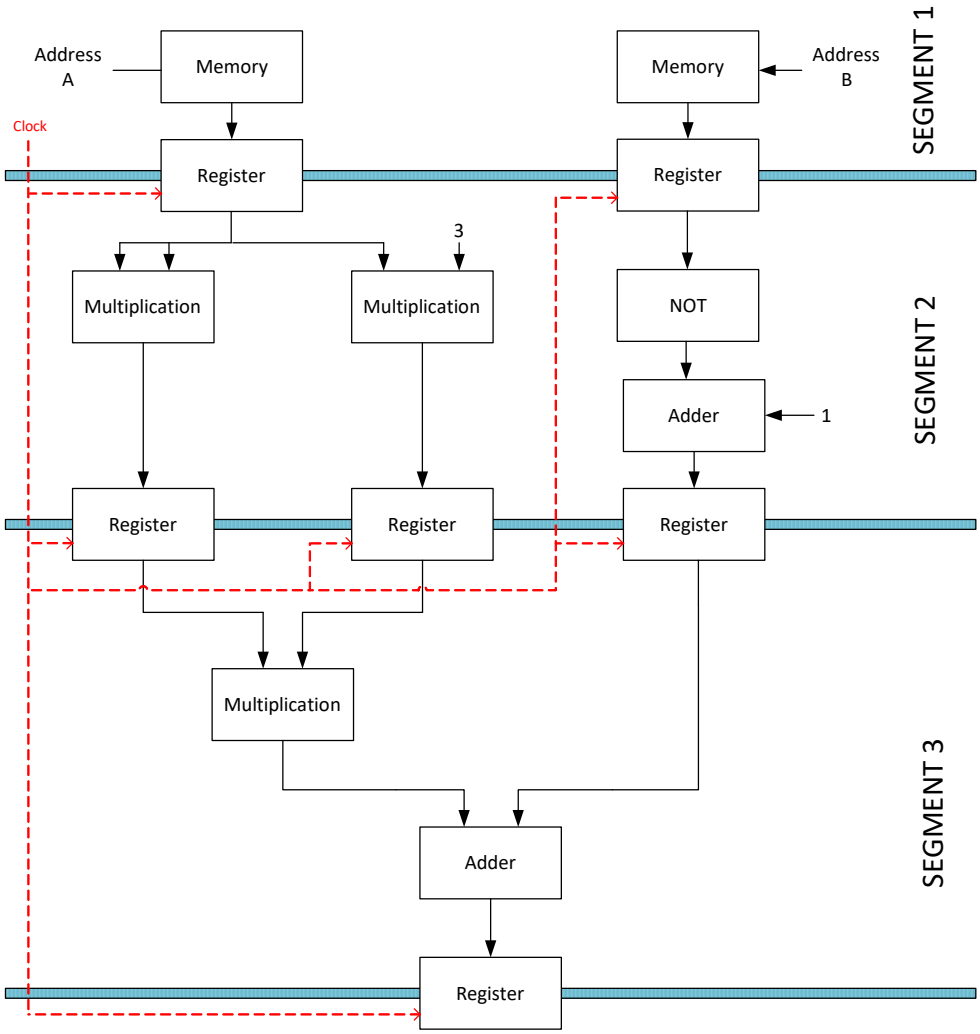
Istanbul Technical University
Department of Computer Engineering

19.02.2020

BLG 322E – Computer Architecture
Assignment 1 Solutions

1)



$T_{Segment1}$ = 50 ns + 5 ns = 55 ns

$T_{Segment2}$ = 10 ns + 20 ns + 5 ns = 35 ns or 30 ns + 5 ns = 35 ns

$T_{Segment3}$ = 30 ns + 20 ns + 5 ns = 55 ns

2) The maximum segment time is 55 ns. Therefore, the clock cycle must be equal to 55 ns.

T_n = 50 ns + 30 ns + 30 ns + 20 ns = 130 ns (Without pipeline)

$$S = \frac{n * t_n}{(\mathrm{k} + \mathrm{n} - 1) * t_p} = \frac{5 * 130}{(3 + 5 - 1) * 55} = 1.68\ (For\ 5\ numbers)$$

$$\lim_{n \to \infty} S = \frac{t_n}{t_p} = \frac{130}{55} = 2.36\ (For\ infinite\ numbers)$$

3) The theoretical speedup = k = 3 (k → number of segments)

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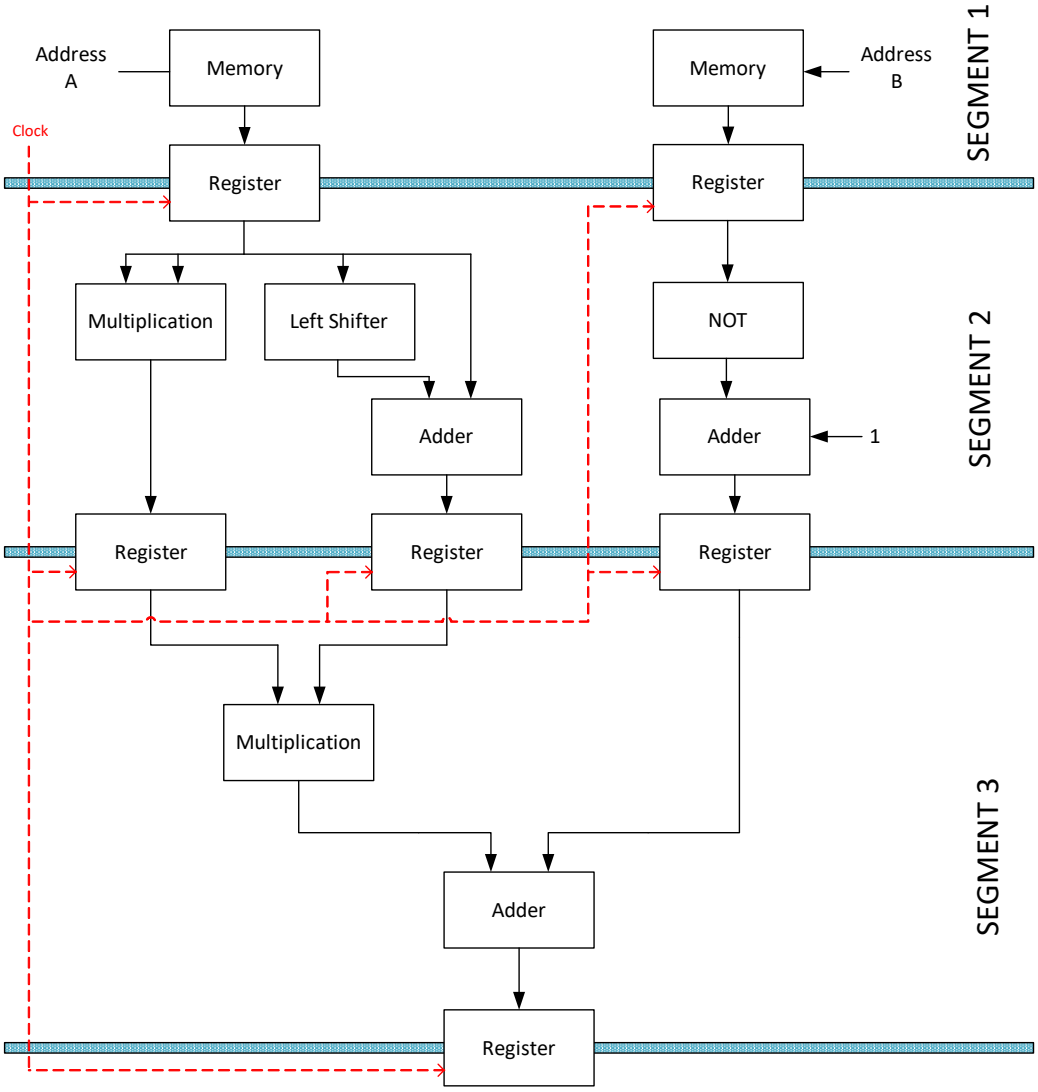
Assignment 1 Alternative Solutions

1)



$T_{Segment1}$ = 50 ns + 5 ns = 55 ns

$T_{Segment2}$ = 15 ns + 20 ns + 5ns = 40 ns

$T_{Segment3}$ = 30 ns + 20 ns + 5 ns = 55 ns

2) The maximum segment time is 55 ns. Therefore, the clock cycle must be equal to 55 ns.

T_n = 50 ns + 15 ns + 20 ns + 30 ns + 20 ns = 135 ns (Without pipeline)

$$S = \frac{n * t_n}{(\mathrm{k} + \mathrm{n} - 1) * t_p} = \frac{5 * 135}{(3 + 5 - 1) * 55} = 1.75\ (For\ 5\ numbers)$$

$$\lim_{n \to \infty} S = \frac{t_n}{t_p} = \frac{135}{55} = 2.45\ (For\ infinite\ numbers)$$

3) The theoretical speedup = k = 3 (k → number of segments)