Assigment 4

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Question 1

$A_k = 1$ and $B_k = 1$ for all k = 0 .. N-1

Question 2

Part a

We know that the delay of an N-bit adder with M-bits per stage is:

$$t_{add} = t_{setup} + M * t_{carry} + \frac{N}{M} * t_{mux} + t_{sum} \tag{1}$$

This means that:

$$t_{add} = 2 + M + \frac{32}{M} + 2 = 4 + M + \frac{32}{M} \tag{2}$$

We know that the delay for an N-bit ripple carry adder is:

$$t_{add,ripple-carry} = (N-1)t_{carry} + t_{sum} = 33 \tag{3}$$

Based on equations (2) and (3) we can claim that if M $\geq$ 3, the carry select adder has less propagation delay than the ripple-carry adder.

Part b

Based on the equations (1) and (3) we can claim:

$$T_{add,select-carry} = 2 + 4 * 1 + \frac{N}{2} * 1 + 2 = \frac{N}{2} + 8 \tag{4}$$

$$T_{add,ripple-carry} = (N-1) * 1 + 2 = N + 1 \tag{5}$$

We assumed that $T_{add,select-carry} < T_{add,ripple-carry}$, that is

$$\frac{N}{2} + 8 \leq N + 1 \tag{6}$$

$$N + 16 \leq 2N + 2 \tag{7}$$

That is N $\geq$ 14. Hence if N $\geq$ 14 then the carry select adder has lesser propagation delay.