Midterm 2016

Q1

$H\,N(N)-1 \qquad N = a_2\,a_1\,a_0$

$q_2\,q_1\,q_0$

$q_2\,q_1\,q_0$

$q_0q_2 \quad q_0q_1 \quad q_0q_0$

$q_1q_2 \quad q_1q_1 \quad q_1q_0$

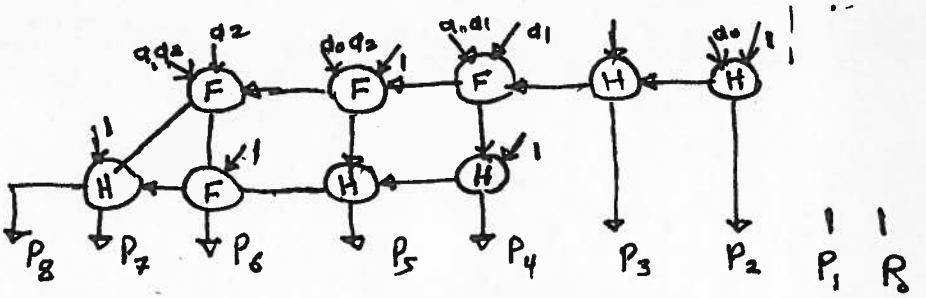
$q_2q_2 \quad q_2q_1 \quad q_2q_0$

$q_1q_2 \quad q_0q_2 \quad q_0q_1 \quad 0 \quad q_0 \quad 0 \quad 0$

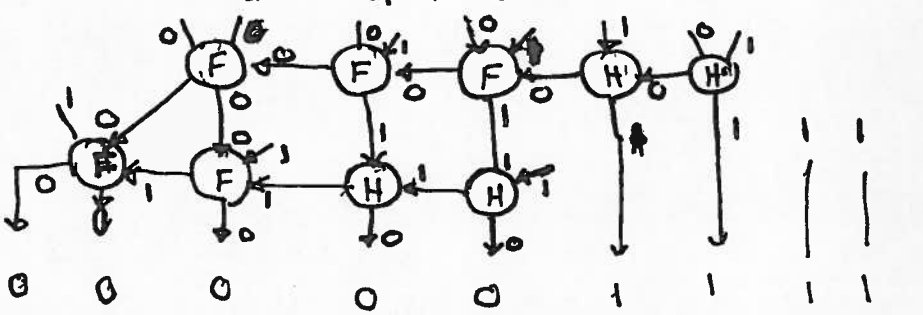
$q_2 \quad 0 \quad q_1 \quad 0 \quad 0$

Shift 2 places to left

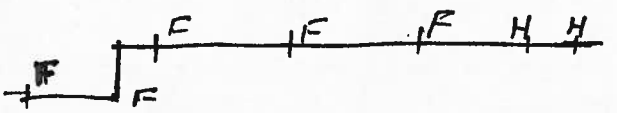
add −1



Implementing the architecture with $N = 2 \rightarrow q_2 = 0 \quad q_1 = 1 \quad q_0 = 0$



$H(2(2))-1 = 15$



$\text{Delay} = 2\tau_H + 5\tau_F + \tau_{AND}$

$A_{req} = 4A_H + 5A_F + 9A_A$

Q 2 midterm Fall 2016

We design an optimum carry select adder & carry ripple adder, determi their delay and area. Multiply delay and area for each case and then select the AT.

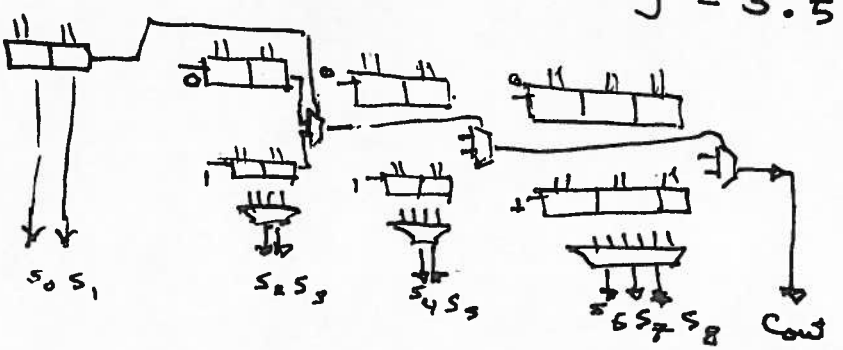
- Carry Ripple Adder

$A_{CRA} = 9 A_{FA}$ Delay $= 9 \tau_{FA}$

- To calculate the best carry select adder we see the best combination that gives the minimum delay as the area is almost constant.

3 3 3	$4 \tau_F$	1 1 1 2 2 2 $3\frac{1}{2} \tau_{FA}$ Area = 17.3
4 5	$5\frac{1}{2} \tau_F$	
5 4	$5\frac{1}{2} \tau_F$	
3 2 2 2	$4\frac{1}{2}$	
✓ 2 2 2 3	$3\frac{1}{2}$ ✓	

Delay $= 3.5 \tau_{FA}$



Area of Design $= 16 FA + 10 MUX = 16 + \frac{10}{3} = 19.3 A_{FA}$

AT of Carry Ripple Adder $= 9 * 9 = 81 \tau$ area

AT of Carry Select Adder $= 3.5 * 19.3 = 67.55 \tau$ area

Therefore The carry select adder is the best design

Midterm Fall 2016

Q3

Using IEEE 754 Format

bias is $E = e^{8-1} - 1 = 127$

$A = 21.75 = 10101.11$ or 1.010111×2^4 $e_A = 4$

Signbit $S = S_A \oplus S_B$

Packed form of A

0	1000 0011	010111000 →
Sign	Exponent	Significand

$B = -7.25 = 111.01 = -1.1101 \times 2^2$ $e_B = 2$

B

1	1000 0001	110100 →

* → $S_R = 1 \oplus 0 = \underline{1}$

→ $e_R = 10000011 + 1000\ 0001 - 0111\ 1111$

$= 10000\ 100 + 1000\ 0001$ ← 2' Complement of 0111 1111

$= 1000\ 0101 = (133)_{10}$

$Sig_R = 1.010111 \times 1.1101$

$Sig_R = 10.0111011011$

```
         1010111
          1.1101
   --------------
         1010111
        0000000
       1010111
      1010111
     1010111
   --------------
   10.0111011011
```

Adjusting exponent & Significand

* $e_R = 1000\ 0101 + 0000\ 0001 = \underline{1000\ 0110}$

$Sig_R = 1.00111011011000000000000000 | 00$ (LSB | R S)

Rounding the results

* $Sig_R = 1.0011101101100000000000000$

Packing the result

1	1000 0110	00111011011000000000000000
Sign of Result	exponent of Result	Significand of result