Problem Set 3

Ch. 4

1) a) $\underset{4^2}{1}\ \underset{4^1}{3}\ \underset{4^0}{3} = 16 + 12 + 3 = 31$

b) $\underset{8^2}{3}\ \underset{8^1}{6}\ \underset{8^0}{7} = 192 + 48 + 7 = 247$

c) $\underset{16^2}{1}\ \underset{16^1}{B}\ \underset{16^0}{A} = 256 + 176 + 10 = 442$

15) a) $\frac{40{,}000 \text{ sample}}{\text{second}} \cdot \frac{16 \text{ bit}}{\text{sample}} \cdot \frac{3 \text{ min}}{1} \cdot \frac{60 \text{ seconds}}{1 \text{ min}} = 115{,}200{,}000 \text{ bits}$

$\frac{115{,}200{,}000}{x} = \frac{5}{1}$ If 5:1 compression ratio: 23,040,000 bits will be used

b) $1200 \times 800 = \frac{960000 \text{ pixels}}{1} \cdot \frac{24 \text{ bits}}{1 \text{ pixel}} = 23040000 \text{ bits}$

24Mbits = 2400000 bits, so in order to compress 23040000 bits, there needs to be a 10:1 ratio for the image

14) a. true
b. false
c. false
d. false
e. false

a. 1?1 OR 2=2
F T
T

b. (2+1) > 2 AND 2<2
T F
F

c. NOT(1=1)
T
F

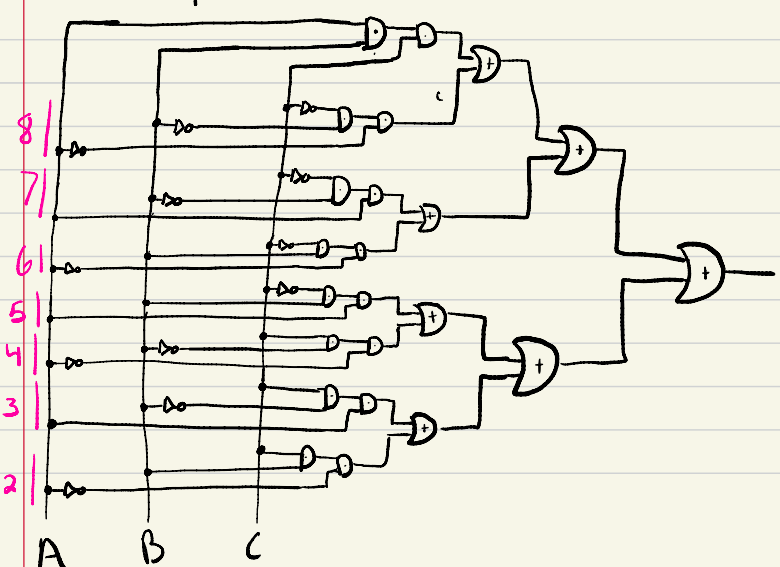
d. Not [(1=2) OR (2=2)]
F T
T
F

e. (1=1) AND (2=1) AND (2=2)
T F T
F

25)

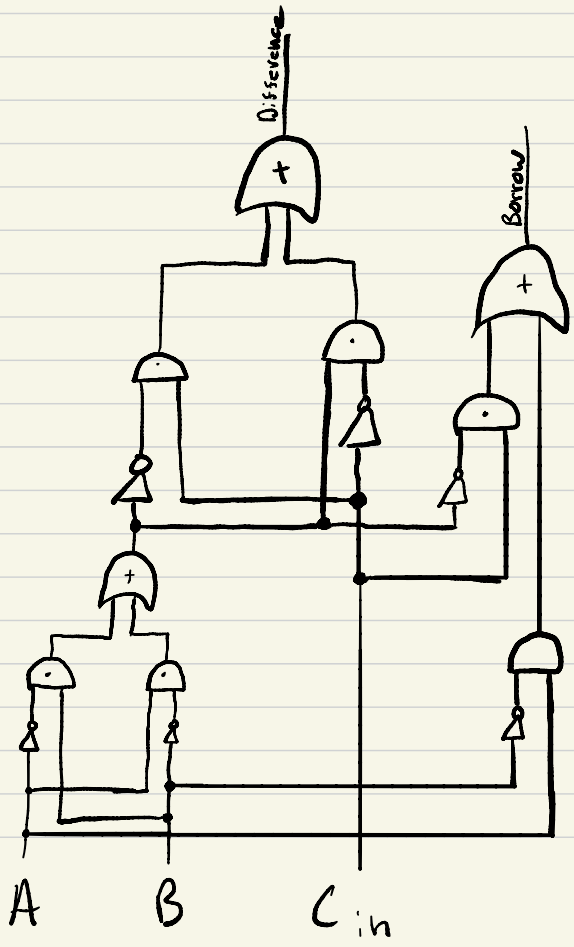
	A	B	C	Output	A B
1	1	1	1	0	A∩B∩C
2	0	1	1	1	¬A∩B∩C
3	1	0	1	1	A∩¬B∩C
4	0	0	1	0	¬A∩¬B∩C
5	1	1	0	1	A∩B∩¬C
6	0	1	0	0	¬A∩B∩¬C
7	1	0	0	0	A∩¬B∩¬C
8	0	0	0	1	¬A∩¬B∩¬C

* Does an and gate with a 0/0 output give you 1?



26)

A	B	C_{in}	Difference		Borrow	
1	1	1	1	$A \cap B \cap C$ [1]	1	$A \cap B \cap C$ [1]
0	1	1	0	$A \cap \neg B \cap \neg C$ [2]	0	$A \cap \neg B \cap \neg C$ [2]
1	0	1	0	$\neg A \cap B \cap \neg C$ [3]	0	$\neg A \cap B \cap \neg C$ [3]
0	0	1	1	$\neg A \cap \neg B \cap C$ [4]	0	$A \cap B \cap \neg C$ [4]
1	1	0	0	$\neg A \cap \neg B \cap C$	1	$A \cap B \cap \neg C$
0	1	0	1	$\neg A \cap B \cap \neg C$	1	$\neg A \cap B \cap \neg C$
1	0	0	1	$A \cap \neg B \cap \neg C$	1	$A \cap \neg B \cap \neg C$
0	0	0	0	$A \cap B \cap C$	0	$A \cap B \cap C$



Ch. 5 19) a) $2^6 =$ 64 distinct operation codes

b) $2^{18} =$ 262,144 bits for memory

c) op code + Ad 1 + Ad 2

6 + 18 + 18

42

$\frac{42 \text{ bits}}{1} \cdot \frac{1 \text{ byte}}{8 \text{ bits}} = 5.25$ bytes

6 bytes are required for each operation

21)

Instructions	Commentary
a) 50. LOAD 200, 202, 203, 204	50. Load V, X, Y, and Z
51. SUBTRACT 202, 203, 200	51. Subtract X-Y and store it in V
52. ADD 200, 204, 200	52. Add Z to V and store it in V
53. HALT	53. End program
b) 50. LOAD 200, 201, 202, 203, 204	50. Load V, W, X, Y, and Z
51. ADD 201, 202, 200	51. Add W to X and store it in V
52. SUBTRACT 200, 203, 200	52. Subtract y from V and store it in V
53. SUBTRACT 200, 204, 200	53. Subtract z from V and store it in V
54. HALT	54. End program
c) 50. LOAD 200, 201, 202, 203, 204	50. Load V, W, X, Y, and Z into the register
51. COMPARE 200, 201	51. If V ≥ W
52. JUMPGT 55	52. Go to 55 if V > W
53. JUMPEQ 55	53. Go to 55 if V = W
54. MOVE 202, 204	54. If W > V set X to Z
55. MOVE 202, 203	55. set X to Y
56. HALT	

V W X Y Z

d)

50. LOAD 200, 201, 202, 203, 204	50. Load V, W, X, Y, Z
51. COMPARE 204, 203	51. If Z > Y
52. JUMPGT 57	52. Go to 57 if Z > Y
53. ADD 203, 201, 203	53. (Y+W) and store it in Y
54. ADD 203, 204, 203	54. (Y+Z) and store it in Y
55. ADD 204, 200, 204	55. (Z+V) and store it in Z
56. JUMPLT 51	56. If Y > Z go to 51
57. HALT	57. Stop

22)

a)

50. LOAD 300, 301, 401	50. Load a, b, 1, 0, and -1
51. ADD 300, 301, 300	51. add a+b and store it in a
52. ADD 300, 401, 300	52. add a to -1 and store it in a
53. HALT	53. Stop

b)

50. LOAD 300, 400, 402	50. Load a, 1, and 0
61. COMPARE 300, 402	51. If a > 0
52. JUMPGT 54	52. go to 54 if a > 0
53. JUMPLT 55	53. go to 55 if 0 > a
54. MOVE 400, 301	54. Set b to 1
55. HALT	55. Stop