Problem 8.1:

a-)

i_3	i_2	i_1	i_0	y_1	y_0	y
0	0	0	0	0	0	0
0	0	0	1	0	0	1
0	0	1	0	0	1	1
0	0	1	1	0	1	1
0	1	0	0	1	0	1
0	1	0	1	1	0	1
0	1	1	0	1	0	1
0	1	1	1	1	0	1
1	0	0	0	1	1	1
1	0	0	1	1	1	1
1	0	1	0	1	1	1
1	0	1	1	1	1	1
1	1	0	0	1	1	1
1	1	0	1	1	1	1
1	1	1	0	1	1	1
1	1	1	1	1	1	1

b-) The boolean expressions are as follow:

$$y = i_0 \vee i_1 \vee i_2 \vee i_3$$

$$y_0 = (i_1 \wedge \neg i_2) \vee i_3$$

$$y_1 = i_2 \vee i_3$$

c-) The circuit we have applies a priority encoder, for instance the output y shows wether there is at least one active input. ~~[illegible]~~ the output y_0 and y_1 shows the number n ~~[illegible]~~ of the highest input i_n that is active.

~~[illegible]~~ *We can use this type of encoders ~~[illegible]~~ to detect or encode the highest interrupt in case multiples are signaled

Problem 8.2:

a-) The numbers we should represent are from 0 to 7, so we will need three inputs to represent it in binary.

lets take x_0, x_1, x_2 such that x_0, x_1, x_2 is the octal representation. Octal numerals can be converted to binary using 3 binary digits.

x_0	x_1	x_2	O
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	0	1	5
1	1	0	6
1	1	1	7

* We deduce the following rules:

I- a and g always on 4↑

II- c and e always On 2↑

III- b and f always On 6↑

IV- d always On in Odd

I-

x_2 \ x_0x_1	00	01	10	11
0	0	0	1	1
1	0	0	1	1

$\Rightarrow x_0$

II-

x_2 \ x_0x_1	00	01	10	11
0	0	1	1	1
1	0	1	1	1

$\Rightarrow x_0 \vee x_1$

III-

x_2 \ x_0x_1	00	01	10	11
0	0	0	1	0
1	0	0	1	0

$\Rightarrow x_0\bar{x}_1$

IV-

x_2 \ x_0x_1	00	01	10	11
0	0	0	0	0
1	1	1	1	1

$\Rightarrow \bar{x}_0 x_2 \vee x_0 \bar{x}_2$