SIMULATED MID-TERM EXAM NOVEMBER 16TH, 2021

Exercise 1:

a) Turn in base 4 the decimal number 243
b) Subtract to the result the number 310_4
c) Turn the resulting number in base 2 and multiply the result by 101_2
d) Turn the result into base 16
e) Consider the number obtained at the end of point (c) as a number in 2-complement and turn it into base 10

Exercise 2: Turn $9{,}375_{10}$ in IEEE half-precision format. Then, sum it to < 1 ; 10000 ; 1101110000 >, write the result in IEEE half-precision format and finally convert the resulting number in base 10.

Exercise 3: By using axioms and laws of Boolean algebra, prove the following equlity:

$$(x \oplus y)(x + \bar{x}y + z)(\bar{y} + \bar{x}y + z) = x \oplus y$$

Exercise 4: Given the side truth table:

a) Compute y2 by using a 4-to-1 MUX
b) Write a minimal POS for y0
c) Write an ALL-NAND expression for y1
d) Realize the whole function by using a ROM

x3	x2	x1	x0	y2	y1	y0
0	0	0	0	0	1	0
0	0	0	1	1	1	0
0	0	1	0	1	1	0
0	0	1	1	1	1	0
0	1	0	0	0	1	1
0	1	0	1	0	1	1
0	1	1	0	1	1	1
0	1	1	1	1	1	1
1	0	0	0	1	0	1
1	0	0	1	1	0	1
1	0	1	0	1	1	0
1	0	1	1	0	1	0
1	1	0	0	-	-	-
1	1	0	1	-	-	-
1	1	1	0	1	1	0
1	1	1	1	1	1	0

Exercise 5: Design a combinatorial net for controlling an irrigation system. The system should be open if the time is between 10pm and 11pm, and either the weather is sunny or the ground is not wet.