

Q1

2 Points

Design a **majority circuit** function with three inputs in the following way:

Q1.1

1 Point

Write the **truth table** of a function $F_3(x, y, z)$, where the output agrees with the majority of the input, that is $F_3(x, y, z) = 1$, if and only if at least two of the three variables: x, y, z have the value 1.

▼ 1.1.pdf Download

1.1 1 / 1 29% +

	x	y	z	F ₃
0	0	0	0	0
1	0	0	1	0
2	0	1	0	0
3	0	1	1	1
4	1	0	0	0
5	1	0	1	1
6	1	1	0	1
7	1	1	1	1

Q1.2

1 Point

Write the expression of a function $F_3(x, y, z)$ as a sum of minterms, and then minimize it by using a **K-Map**.

Q2

3 Points

Design a **majority circuit** function $F_4(x, y, z, t)$ with four inputs. Handle the **tie conditions** in a way that is **optimal** from the point of view of minimization of F_4 .

Q2.1

1 Point

Write the **truth table** for F_4 .

2.1.pdf Download

2.1 1 / 1 29% + [Icons]

The image shows a handwritten truth table for the function $F_4(x, y, z, t)$. The table has 5 columns: x , y , z , t , and F_4 . The rows are numbered 1 to 15. The values for F_4 are 1 for rows 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15, and 0 for rows 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

	x	y	z	t	F_4
1	0	0	0	0	1
2	0	0	0	1	1
3	0	0	1	0	1
4	0	0	1	1	1
5	0	1	0	0	1
6	0	1	0	1	1
7	0	1	1	0	1
8	0	1	1	1	1
9	1	0	0	0	1
10	1	0	0	1	1
11	1	0	1	0	1
12	1	0	1	1	1
13	1	1	0	0	1
14	1	1	0	1	1
15	1	1	1	0	1
16	1	1	1	1	0
17	0	0	0	0	0
18	0	0	0	1	0
19	0	0	1	0	0
20	0	0	1	1	0
21	0	1	0	0	0
22	0	1	0	1	0
23	0	1	1	0	0
24	0	1	1	1	0
25	1	0	0	0	0
26	1	0	0	1	0
27	1	0	1	0	0
28	1	0	1	1	0
29	1	1	0	0	0
30	1	1	0	1	0
31	1	1	1	0	0
32	1	1	1	1	0
33	0	0	0	0	0
34	0	0	0	1	0
35	0	0	1	0	0
36	0	0	1	1	0
37	0	1	0	0	0
38	0	1	0	1	0
39	0	1	1	0	0
40	0	1	1	1	0
41	1	0	0	0	0
42	1	0	0	1	0
43	1	0	1	0	0
44	1	0	1	1	0
45	1	1	0	0	0
46	1	1	0	1	0
47	1	1	1	0	0
48	1	1	1	1	0
49	0	0	0	0	0
50	0	0	0	1	0
51	0	0	1	0	0
52	0	0	1	1	0
53	0	1	0	0	0
54	0	1	0	1	0
55	0	1	1	0	0
56	0	1	1	1	0
57	1	0	0	0	0
58	1	0	0	1	0
59	1	0	1	0	0
60	1	0	1	1	0
61	1	1	0	0	0
62	1	1	0	1	0
63	1	1	1	0	0
64	1	1	1	1	0
65	0	0	0	0	0
66	0	0	0	1	0
67	0	0	1	0	0
68	0	0	1	1	0
69	0	1	0	0	0
70	0	1	0	1	0
71	0	1	1	0	0
72	0	1	1	1	0
73	1	0	0	0	0
74	1	0	0	1	0
75	1	0	1	0	0
76	1	0	1	1	0
77	1	1	0	0	0
78	1	1	0	1	0
79	1	1	1	0	0
80	1	1	1	1	0
81	0	0	0	0	0
82	0	0	0	1	0
83	0	0	1	0	0
84	0	0	1	1	0
85	0	1	0	0	0
86	0	1	0	1	0
87	0	1	1	0	0
88	0	1	1	1	0
89	1	0	0	0	0
90	1	0	0	1	0
91	1	0	1	0	0
92	1	0	1	1	0
93	1	1	0	0	0
94	1	1	0	1	0
95	1	1	1	0	0
96	1	1	1	1	0
97	0	0	0	0	0
98	0	0	0	1	0
99	0	0	1	0	0
100	0	0	1	1	0

Q2.2

1 Point

Draw the **K-Map** for F_4 .

Q2.3 Extra Credit

1 Point

Derive all minimal forms of F_4 from the K-Map.