Quine–McCluskey algorithm

The function that is minimized can be entered via a truth table that represents the function $y = \mathrm{f}(x_n,\ldots,x_1, x_0)$. You can manually edit this function by clicking on the gray elements in the y column. Alternatively, you can generate a random function by pressing the "Random example" button.

Random example

Number of input variables: 6 Allow Don’t-Care: Yes

Truth table:

	x_5	x_4	x_3	x_2	x_1	x_0	y
0:	0	0	0	0	0	0	×
1:	0	0	0	0	0	1	×
2:	0	0	0	0	1	0	0
3:	0	0	0	0	1	1	0
4:	0	0	0	1	0	0	×
5:	0	0	0	1	0	1	0
6:	0	0	0	1	1	0	×
7:	0	0	0	1	1	1	1
8:	0	0	1	0	0	0	×
9:	0	0	1	0	0	1	×
10:	0	0	1	0	1	0	×
11:	0	0	1	0	1	1	0
12:	0	0	1	1	0	0	×
13:	0	0	1	1	0	1	0
14:	0	0	1	1	1	0	×
15:	0	0	1	1	1	1	×
16:	0	1	0	0	0	0	×
17:	0	1	0	0	0	1	1
18:	0	1	0	0	1	0	×
19:	0	1	0	0	1	1	0
20:	0	1	0	1	0	0	×
21:	0	1	0	1	0	1	×
22:	0	1	0	1	1	0	×
23:	0	1	0	1	1	1	0
24:	0	1	1	0	0	0	×
25:	0	1	1	0	0	1	×
26:	0	1	1	0	1	0	×
27:	0	1	1	0	1	1	×
28:	0	1	1	1	0	0	×
29:	0	1	1	1	0	1	0
30:	0	1	1	1	1	0	×
31:	0	1	1	1	1	1	0
32:	1	0	0	0	0	0	×
33:	1	0	0	0	0	1	×
34:	1	0	0	0	1	0	×
35:	1	0	0	0	1	1	×
36:	1	0	0	1	0	0	×
37:	1	0	0	1	0	1	0
38:	1	0	0	1	1	0	×

Implicants (Order 0):

	x_5	x_4	x_3	x_2	x_1	x_0	
0:	0	0	0	0	0	0	→
1:	0	0	0	0	0	1	→
4:	0	0	0	1	0	0	→
6:	0	0	0	1	1	0	→
7:	0	0	0	1	1	1	→
8:	0	0	1	0	0	0	→
9:	0	0	1	0	0	1	→
10:	0	0	1	0	1	0	→
12:	0	0	1	1	0	0	→
14:	0	0	1	1	1	0	→
15:	0	0	1	1	1	1	→
16:	0	1	0	0	0	0	→
17:	0	1	0	0	0	1	→
18:	0	1	0	0	1	0	→
20:	0	1	0	1	0	0	→
21:	0	1	0	1	0	1	→
22:	0	1	0	1	1	0	→
24:	0	1	1	0	0	0	→
25:	0	1	1	0	0	1	→
26:	0	1	1	0	1	0	→
27:	0	1	1	0	1	1	→
28:	0	1	1	1	0	0	→
30:	0	1	1	1	1	0	→
32:	1	0	0	0	0	0	→
33:	1	0	0	0	0	1	→
34:	1	0	0	0	1	0	→
35:	1	0	0	0	1	1	→
36:	1	0	0	1	0	0	→
38:	1	0	0	1	1	0	→
39:	1	0	0	1	1	1	→
40:	1	0	1	0	0	0	→
42:	1	0	1	0	1	0	→
44:	1	0	1	1	0	0	→
45:	1	0	1	1	0	1	→
46:	1	0	1	1	1	0	→
48:	1	1	0	0	0	0	→
49:	1	1	0	0	0	1	→
50:	1	1	0	0	1	0	→
51:	1	1	0	0	1	1	→

39:	1	0	0	1	1	1	×
40:	1	0	1	0	0	0	×
41:	1	0	1	0	0	1	0
42:	1	0	1	0	1	0	×
43:	1	0	1	0	1	1	0
44:	1	0	1	1	0	0	×
45:	1	0	1	1	0	1	×
46:	1	0	1	1	1	0	×
47:	1	0	1	1	1	1	0
48:	1	1	0	0	0	0	×
49:	1	1	0	0	0	1	×
50:	1	1	0	0	1	0	×
51:	1	1	0	0	1	1	×
52:	1	1	0	1	0	0	×
53:	1	1	0	1	0	1	0
54:	1	1	0	1	1	0	×
55:	1	1	0	1	1	1	×
56:	1	1	1	0	0	0	×
57:	1	1	1	0	0	1	×
58:	1	1	1	0	1	0	×
59:	1	1	1	0	1	1	0
60:	1	1	1	1	0	0	×
61:	1	1	1	1	0	1	0
62:	1	1	1	1	1	0	×
63:	1	1	1	1	1	1	×

52:	1	1	0	1	0	0	→
54:	1	1	0	1	1	0	→
55:	1	1	0	1	1	1	→
56:	1	1	1	0	0	0	→
57:	1	1	1	0	0	1	→
58:	1	1	1	0	1	0	→
60:	1	1	1	1	0	0	→
62:	1	1	1	1	1	0	→
63:	1	1	1	1	1	1	→

Implicants (Order 1):

	x_5	x_4	x_3	x_2	x_1	x_0	
0, 1:	0	0	0	0	0	-	→
0, 4:	0	0	0	-	0	0	→
0, 8:	0	0	-	0	0	0	→
0, 16:	0	-	0	0	0	0	→
0, 32:	-	0	0	0	0	0	→
1, 9:	0	0	-	0	0	1	→
1, 17:	0	-	0	0	0	1	→
1, 33:	-	0	0	0	0	1	→
4, 6:	0	0	0	1	-	0	→
4, 12:	0	0	-	1	0	0	→
4, 20:	0	-	0	1	0	0	→
4, 36:	-	0	0	1	0	0	→
6, 7:	0	0	0	1	1	-	→
6, 14:	0	0	-	1	1	0	→
6, 22:	0	-	0	1	1	0	→
6, 38:	-	0	0	1	1	0	→
7, 15:	0	0	-	1	1	1	→
7, 39:	-	0	0	1	1	1	→
8, 9:	0	0	1	0	0	-	→
8, 10:	0	0	1	0	-	0	→
8, 12:	0	0	1	-	0	0	→
8, 24:	0	-	1	0	0	0	→
8, 40:	-	0	1	0	0	0	→

Implicants (Order 2):

	x_5	x_4	x_3	x_2	x_1	x_0	
0, 1, 8, 9:	0	0	-	0	0	-	→
0, 1, 16, 17:	0	-	0	0	0	-	→
0, 1, 32, 33:	-	0	0	0	0	-	→
0, 4, 8, 12:	0	0	-	-	0	0	→
0, 4, 16, 20:	0	-	0	-	0	0	→
0, 4, 32, 36:	-	0	0	-	0	0	→
0, 8, 16, 24:	0	-	-	0	0	0	→
0, 8, 32, 40:	-	0	-	0	0	0	→
0, 16, 32, 48:	-	-	0	0	0	0	→
1, 9, 17, 25:	0	-	-	0	0	1	→
1, 17, 33, 49:	-	-	0	0	0	1	→
4, 6, 12, 14:	0	0	-	1	-	0	→
4, 6, 20, 22:	0	-	0	1	-	0	→
4, 6, 36, 38:	-	0	0	1	-	0	→
4, 12, 20, 28:	0	-	-	1	0	0	→
4, 12, 36, 44:	-	0	-	1	0	0	→
4, 20, 36, 52:	-	-	0	1	0	0	→
6, 7, 14, 15:	0	0	-	1	1	-	✓
6, 7, 38, 39:	-	0	0	1	1	-	✓
6, 14, 22, 30:	0	-	-	1	1	0	→
6, 14, 38, 46:	-	0	-	1	1	0	→
6, 22, 38, 54:	-	-	0	1	1	0	→
8, 9, 24, 25:	0	-	1	0	0	-	→

8, 40:	-	0	1	0	0	0	→
9, 25:	0	-	1	0	0	1	→
10, 14:	0	0	1	-	1	0	→
10, 26:	0	-	1	0	1	0	→
10, 42:	-	0	1	0	1	0	→
12, 14:	0	0	1	1	-	0	→
12, 28:	0	-	1	1	0	0	→
12, 44:	-	0	1	1	0	0	→
14, 15:	0	0	1	1	1	-	→
14, 30:	0	-	1	1	1	0	→
14, 46:	-	0	1	1	1	0	→
16, 17:	0	1	0	0	0	-	→
16, 18:	0	1	0	0	-	0	→
16, 20:	0	1	0	-	0	0	→
16, 24:	0	1	-	0	0	0	→
16, 48:	-	1	0	0	0	0	→
17, 21:	0	1	0	-	0	1	→
17, 25:	0	1	-	0	0	1	→
17, 49:	-	1	0	0	0	1	→
18, 22:	0	1	0	-	1	0	→
18, 26:	0	1	-	0	1	0	→
18, 50:	-	1	0	0	1	0	→
20, 21:	0	1	0	1	0	-	→
20, 22:	0	1	0	1	-	0	→
20, 28:	0	1	-	1	0	0	→
20, 52:	-	1	0	1	0	0	→
22, 30:	0	1	-	1	1	0	→
22, 54:	-	1	0	1	1	0	→
24, 25:	0	1	1	0	0	-	→
24, 26:	0	1	1	0	-	0	→
24, 28:	0	1	1	-	0	0	→
24, 56:	-	1	1	0	0	0	→
25, 27:	0	1	1	0	-	1	→
25, 57:	-	1	1	0	0	1	→
26, 27:	0	1	1	0	1	-	→
26, 30:	0	1	1	-	1	0	→
26, 58:	-	1	1	0	1	0	→
28, 30:	0	1	1	1	-	0	→
28, 60:	-	1	1	1	0	0	→
30, 62:	-	1	1	1	1	0	→
32, 33:	1	0	0	0	0	-	→
32, 34:	1	0	0	0	-	0	→
32, 36:	1	0	0	-	0	0	→
32, 40:	1	0	-	0	0	0	→
32, 48:	1	-	0	0	0	0	→
33, 35:	1	0	0	0	-	1	→
33, 49:	1	-	0	0	0	1	→
34, 35:	1	0	0	0	1	-	→
34, 38:	1	0	0	-	1	0	→
34, 42:	1	0	-	0	1	0	→
34, 50:	1	-	0	0	1	0	→
35, 39:	1	0	0	-	1	1	

8, 9, 24, 25:	0	-	1	0	0	-	→
8, 10, 12, 14:	0	0	1	-	-	0	→
8, 10, 24, 26:	0	-	1	0	-	0	→
8, 10, 40, 42:	-	0	1	0	-	0	→
8, 12, 24, 28:	0	-	1	-	0	0	→
8, 12, 40, 44:	-	0	1	-	0	0	→
8, 24, 40, 56:	-	-	1	0	0	0	→
10, 14, 26, 30:	0	-	1	-	1	0	→
10, 14, 42, 46:	-	0	1	-	1	0	→
10, 26, 42, 58:	-	-	1	0	1	0	→
12, 14, 28, 30:	0	-	1	1	-	0	→
12, 14, 44, 46:	-	0	1	1	-	0	→
12, 28, 44, 60:	-	-	1	1	0	0	→
14, 30, 46, 62:	-	-	1	1	1	0	→
16, 17, 20, 21:	0	1	0	-	0	-	✓
16, 17, 24, 25:	0	1	-	0	0	-	→
16, 17, 48, 49:	-	1	0	0	0	-	→
16, 18, 20, 22:	0	1	0	-	-	0	→
16, 18, 24, 26:	0	1	-	0	-	0	→
16, 18, 48, 50:	-	1	0	0	-	0	→
16, 20, 24, 28:	0	1	-	-	0	0	→
16, 20, 48, 52:	-	1	0	-	0	0	→
16, 24, 48, 56:	-	1	-	0	0	0	→
17, 25, 49, 57:	-	1	-	0	0	1	→
18, 22, 26, 30:	0	1	-	-	1	0	→
18, 22, 50, 54:	-	1	0	-	1	0	→
18, 26, 50, 58:	-	1	-	0	1	0	→
20, 22, 28, 30:	0	1	-	1	-	0	→
20, 22, 52, 54:	-	1	0	1	-	0	→
20, 28, 52, 60:	-	1	-	1	0	0	→
22, 30, 54, 62:	-	1	-	1	1	0	→
24, 25, 26, 27:	0	1	1	0	-	-	(×)
24, 25, 56, 57:	-	1	1	0	0	-	→
24, 26, 28, 30:	0	1	1	-	-	0	→
24, 26, 56, 58:	-	1	1	0	-	0	→
24, 28, 56, 60:	-	1	1	-	0	0	→
26, 30, 58, 62:	-	1	1	-	1	0	→
28, 30, 60, 62:	-	1	1	1	-	0	→
32, 33, 34, 35:	1	0	0	0	-	-	→
32, 33, 48, 49:	1	-	0	0	0	-	→
32, 34, 36, 38:	1	0	0	-	-	0	→
32, 34, 40, 42:	1	0	-	0	-	0	→
32, 34, 48, 50:	1	-	0	0	-	0	→
32, 36, 40, 44:	1	0	-	-	0	0	→
32, 36, 48, 52:	1	-	0	-	0	0	→
32, 40, 48, 56:	1	-	-	0	0	0	→
33, 35, 49, 51:	1	-	0	0	-	1	→
34, 35, 38, 39:	1	0	0	-	1	-	→
34, 35, 50, 51:	1	-	0	0	1	-	→
34, 38, 42, 46:	1	0	-	-	1	0	→
34, 38, 50, 54:	1	-	0	-	1	0	→
34, 42, 50, 58:	1	-	-	0	1	0	

35, 39:	1	0	0	-	1	1	→
35, 51:	1	-	0	0	1	1	→
36, 38:	1	0	0	1	-	0	→
36, 44:	1	0	-	1	0	0	→
36, 52:	1	-	0	1	0	0	→
38, 39:	1	0	0	1	1	-	→
38, 46:	1	0	-	1	1	0	→
38, 54:	1	-	0	1	1	0	→
39, 55:	1	-	0	1	1	1	→
40, 42:	1	0	1	0	-	0	→
40, 44:	1	0	1	-	0	0	→
40, 56:	1	-	1	0	0	0	→
42, 46:	1	0	1	-	1	0	→
42, 58:	1	-	1	0	1	0	→
44, 45:	1	0	1	1	0	-	(×)
44, 46:	1	0	1	1	-	0	→
44, 60:	1	-	1	1	0	0	→
46, 62:	1	-	1	1	1	0	→
48, 49:	1	1	0	0	0	-	→
48, 50:	1	1	0	0	-	0	→
48, 52:	1	1	0	-	0	0	→
48, 56:	1	1	-	0	0	0	→
49, 51:	1	1	0	0	-	1	→
49, 57:	1	1	-	0	0	1	→
50, 51:	1	1	0	0	1	-	→
50, 54:	1	1	0	-	1	0	→
50, 58:	1	1	-	0	1	0	→
51, 55:	1	1	0	-	1	1	→
52, 54:	1	1	0	1	-	0	→
52, 60:	1	1	-	1	0	0	→
54, 55:	1	1	0	1	1	-	→
54, 62:	1	1	-	1	1	0	→
55, 63:	1	1	-	1	1	1	→
56, 57:	1	1	1	0	0	-	→
56, 58:	1	1	1	0	-	0	→
56, 60:	1	1	1	-	0	0	→
58, 62:	1	1	1	-	1	0	→
60, 62:	1	1	1	1	-	0	→
62, 63:	1	1	1	1	1	-	→

34, 42, 50, 58:	1	-	-	0	1	0	→
35, 39, 51, 55:	1	-	0	-	1	1	→
36, 38, 44, 46:	1	0	-	1	-	0	→
36, 38, 52, 54:	1	-	0	1	-	0	→
36, 44, 52, 60:	1	-	-	1	0	0	→
38, 39, 54, 55:	1	-	0	1	1	-	→
38, 46, 54, 62:	1	-	-	1	1	0	→
40, 42, 44, 46:	1	0	1	-	-	0	→
40, 42, 56, 58:	1	-	1	0	-	0	→
40, 44, 56, 60:	1	-	1	-	0	0	→
42, 46, 58, 62:	1	-	1	-	1	0	→
44, 46, 60, 62:	1	-	1	1	-	0	→
48, 49, 50, 51:	1	1	0	0	-	-	→
48, 49, 56, 57:	1	1	-	0	0	-	→
48, 50, 52, 54:	1	1	0	-	-	0	→
48, 50, 56, 58:	1	1	-	0	-	0	→
48, 52, 56, 60:	1	1	-	-	0	0	→
50, 51, 54, 55:	1	1	0	-	1	-	→
50, 54, 58, 62:	1	1	-	-	1	0	→
52, 54, 60, 62:	1	1	-	1	-	0	→
54, 55, 62, 63:	1	1	-	1	1	-	(×)
56, 58, 60, 62:	1	1	1	-	-	0	→

Implicants (Order 3):

	x_5	x_4	x_3	x_2	x_1	x_0	
0, 1, 8, 9, 16, 17, 24, 25:	0	-	-	0	0	-	✓
0, 1, 16, 17, 32, 33, 48, 49:	-	-	0	0	0	-	✓
0, 4, 8, 12, 16, 20, 24, 28:	0	-	-	-	0	0	→
0, 4, 8, 12, 32, 36, 40, 44:	-	0	-	-	0	0	→
0, 4, 16, 20, 32, 36, 48, 52:	-	-	0	-	0	0	→
0, 8, 16, 24, 32, 40, 48, 56:	-	-	-	0	0	0	→
4, 6, 12, 14, 20, 22, 28, 30:	0	-	-	1	-	0	→
4, 6, 12, 14, 36, 38, 44, 46:	-	0	-	1	-	0	→
4, 6, 20, 22, 36, 38, 52, 54:	-	-	0	1	-	0	→
4, 12, 20, 28, 36, 44, 52, 60:	-	-	-	1	0	0	→
6, 14, 22, 30, 38, 46, 54, 62:	-	-	-	1	1	0	→
8, 10, 12, 14, 24, 26, 28, 30:	0	-	1	-	-	0	→
8, 10, 12, 14, 40, 42, 44, 46:	-	0	1	-	-	0	→
8, 10, 24, 26, 40, 42, 56, 58:	-	-	1	0	-	0	→
8, 12, 24, 28, 40, 44, 56, 60:	-	-	1	-	0	0	→
10, 14, 26, 30, 42, 46, 58, 62:	-	-	1	-	1	0	→
12, 14, 28, 30, 44, 46, 60, 62:	-	-	1	1	-	0	→
16, 17, 24, 25, 48, 49, 56, 57:	-	1	-	0	0	-	✓
16, 18, 20, 22, 24, 26, 28, 30:	0	1	-	-	-	0	→
16, 18, 20, 22, 48, 50, 52, 54:	-	1	0	-	-	0	→
16, 18, 24, 26, 48, 50, 56, 58:	-	1	-	0	-	0	→
16, 20, 24, 28, 48, 52, 56, 60:	-	1	-	-	0	0	→
18, 22, 26, 30, 50, 54, 58, 62:	-	1	-	-	1	0	→
20, 22, 28, 30, 52, 54, 60, 62:	-	1	-	1	-	0	→
24, 26, 28, 30, 56, 58, 60, 62:	-	1	1	-	-	0	→
32, 33, 34, 35, 48, 49, 50, 51:	1	-	0	0	-	-	(×)
32, 34, 36, 38, 40, 42, 44, 46:	1	0	-	-	-	0	→
32, 34, 36, 38, 48, 50, 52, 54:	1	-	0	-	-	0	→
32, 34, 40, 42, 48, 50, 56, 58:	1	-	-	0	-	0	→
32, 36, 40, 44, 48, 52, 56, 60:	1	-	-	-	0	0	→
34, 35, 38, 39, 50, 51, 54, 55:	1	-	0	-	1	-	(×)
34, 38, 42, 46, 50, 54, 58, 62:	1	-	-	-	1	0	→
36, 38, 44, 46, 52, 54, 60, 62:	1	-	-	1	-	0	→
40, 42, 44, 46, 56, 58, 60, 62:	1	-	1	-	-	0	→
48, 50, 52, 54, 56, 58, 60, 62:	1	1	-	-	-	0	→

Implicants (Order 4):

	x_5	x_4	x_3	x_2	x_1	x_0	
0, 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, 60:	-	-	-	-	0	0	(×)
4, 6, 12, 14, 20, 22, 28, 30, 36, 38, 44, 46, 52, 54, 60, 62:	-	-	-	1	-	0	(×)
8, 10, 12, 14, 24, 26, 28, 30, 40, 42, 44, 46, 56, 58, 60, 62:	-	-	1	-	-	0	(×)
16, 18, 20, 22, 24, 26, 28, 30, 48, 50, 52, 54, 56, 58, 60, 62:	-	1	-	-	-	0	(×)
32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62:	1	-	-	-	-	0	(×)

Prime implicant chart:

	x_5	x_4	x_3	x_2	x_1	x_0	7	17	
0, 1, 8, 9, 16, 17, 24, 25:	0	-	-	0	0	-		○	$(\bar{x}_5\bar{x}_2\bar{x}_1) \equiv p_0$
0, 1, 16, 17, 32, 33, 48, 49:	-	-	0	0	0	-		○	$(\bar{x}_3\bar{x}_2\bar{x}_1) \equiv p_1$
16, 17, 24, 25, 48, 49, 56, 57:	-	1	-	0	0	-		○	$(x_4\bar{x}_2\bar{x}_1) \equiv p_2$
6, 7, 14, 15:	0	0	-	1	1	-	○		$(\bar{x}_5\bar{x}_4x_2x_1) \equiv p_3$
6, 7, 38, 39:	-	0	0	1	1	-	○		$(\bar{x}_4\bar{x}_3x_2x_1) \equiv p_4$
16, 17, 20, 21:	0	1	0	-	0	-		○	$(\bar{x}_5x_4\bar{x}_3\bar{x}_1) \equiv p_5$

Petrick's method

$(p_3 \vee p_4)(p_0 \vee p_1 \vee p_2 \vee p_5)$

$\Leftrightarrow (p_0p_3 \vee p_1p_3 \vee p_2p_3 \vee p_3p_5 \vee p_0p_4 \vee p_1p_4 \vee p_2p_4 \vee p_4p_5)$

$\Leftrightarrow (p_0p_3 \vee p_1p_3 \vee p_2p_3 \vee p_3p_5 \vee p_0p_4 \vee p_1p_4 \vee p_2p_4 \vee p_4p_5)$

Extracted prime implicants (Petrick's method): $(\bar{x}_5\bar{x}_4x_2x_1)$, $(\bar{x}_5x_4\bar{x}_3\bar{x}_1)$

Minimal boolean expression:

$y = (\bar{x}_5\bar{x}_4x_2x_1) \vee (\bar{x}_5x_4\bar{x}_3\bar{x}_1)$

Legend:
Don't-care: ×
Implicant (non prime): →
Prime implicant: ✓
Essential prime implicant: ●
Prime implicant but covers only don't-care: (×)

The JavaScript source code can be found here: qmc.js.

This website is part of the lecture Technical Computer Science.

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