

1 Introduction

This is a (large) set of example Boolean minimisation questions: each asks you to transform some truth table describing an n -input Boolean function into a Boolean expression. Each solution includes

1. a reference implementation (produced by forming a SoP expression with a full term for *each* minterm, i.e., row where $r = 1$), and
2. a Karnaugh map annotated with sensible groups, and an optimised implementation based on those groups.

The goal is to focus on producing the latter, since the former is somewhat easier. Keep in mind the following:

- There are 2^{2^n} Boolean functions with n inputs (or 3^{2^n} if you include don't-care states): for small enough n , a complete set of functions is included.
- I made no real effort to order the questions, and only minor effort to avoid duplicates; the questions should include no trivial (in the sense $r = 1$ or $r = 0$ for all inputs, e.g., a tautology) cases.
- The questions and solutions are generated automatically, meaning a small but real chance of bugs in my implementation. The number of questions makes this hard to check by hand. If you find a solution you think is wrong for some reason, check what you are doing then let me know: I will try to resolve the problem.

2 2-input problems

2.1 Without don't-care states

Q1.

y	z	r
0	0	1
0	1	0
1	0	1
1	1	1

Q2.

y	z	r
0	0	1
0	1	1
1	0	0
1	1	1

Q3.

y	z	r
0	0	1
0	1	0
1	0	0
1	1	0

Q4.

y	z	r
0	0	0
0	1	1
1	0	1
1	1	0

Q5.

y	z	r
0	0	1
0	1	0
1	0	1
1	1	0

Q6.

y	z	r
0	0	0
0	1	0
1	0	0
1	1	1

Q7.

y	z	r
0	0	0
0	1	0
1	0	1
1	1	1

Q8.

y	z	r
0	0	1
0	1	0
1	0	0
1	1	1

Q9.

y	z	r
0	0	0
0	1	1
1	0	0
1	1	0

Q10.

y	z	r
0	0	0
0	1	0
1	0	1
1	1	0

Q11.

y	z	r
0	0	0
0	1	1
1	0	0
1	1	1

Q12.

y	z	r
0	0	1
0	1	1
1	0	1
1	1	0

Q13.

y	z	r
0	0	0
0	1	1
1	0	1
1	1	1

Q14.

y	z	r
0	0	1
0	1	1
1	0	0
1	1	0

2.2 With don't-care states

Q15.

y	z	r
0	0	0
0	1	1
1	0	1
1	1	?

Q16.

y	z	r
0	0	0
0	1	1
1	0	?
1	1	?

Q17.

y	z	r
0	0	0
0	1	?
1	0	?
1	1	1

Q18.

y	z	r
0	0	1
0	1	?
1	0	0
1	1	0

Q19.

y	z	r
0	0	?
0	1	0
1	0	1
1	1	0

Q20.

y	z	r
0	0	1
0	1	?
1	0	1
1	1	0

Q21.

y	z	r
0	0	1
0	1	0
1	0	0
1	1	?

Q22.

y	z	r
0	0	1
0	1	0
1	0	0
1	1	0

Q23.

y	z	r
0	0	1
0	1	0
1	0	1
1	1	?

Q24.

y	z	r
0	0	0
0	1	1
1	0	1
1	1	1

Q25.

y	z	r
0	0	1
0	1	?
1	0	0
1	1	1

Q26.

y	z	r
0	0	?
0	1	0
1	0	1
1	1	1

Q27.

y	z	r
0	0	1
0	1	?
1	0	0
1	1	?

Q28.

y	z	r
0	0	1
0	1	1
1	0	0
1	1	1

Q29.

y	z	r
0	0	?
0	1	1
1	0	0
1	1	?

Q30.

y	z	r
0	0	0
0	1	1
1	0	?
1	1	0

Q31.

y	z	r
0	0	0
0	1	0
1	0	0
1	1	1

Q32.

y	z	r
0	0	0
0	1	1
1	0	0
1	1	1

Q33.

y	z	r
0	0	0
0	1	?
1	0	1
1	1	1

Q34.

y	z	r
0	0	0
0	1	1
1	0	1
1	1	0

Q35.

y	z	r
0	0	?
0	1	?
1	0	1
1	1	0

Q36.

y	z	r
0	0	1
0	1	1
1	0	0
1	1	0

Q37.

y	z	r
0	0	0
0	1	0
1	0	?
1	1	1

Q38.

y	z	r
0	0	?
0	1	0
1	0	0
1	1	1

Q39.

y	z	r
0	0	0
0	1	1
1	0	?
1	1	1

Q40.

y	z	r
0	0	?
0	1	1
1	0	0
1	1	0

Q41.

y	z	r
0	0	1
0	1	1
1	0	?
1	1	0

Q42.

y	z	r
0	0	?
0	1	1
1	0	1
1	1	0

Q43.

y	z	r
0	0	?
0	1	0
1	0	?
1	1	1

Q44.

y	z	r
0	0	1
0	1	0
1	0	?
1	1	1

Q45.

y	z	r
0	0	0
0	1	1
1	0	0
1	1	?

3 3-input problems

3.1 Without don't-care states

Q46.

x	y	z	r
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

Q47.

x	y	z	r
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	0

Q48.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

Q49.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

Q50.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

Q51.

x	y	z	r
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

Q52.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

Q53.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

Q54.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

Q55.

x	y	z	r
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

Q56.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

Q57.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

Q58.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

Q59.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

Q60.

x	y	z	r
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	0

Q61.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

Q62.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

Q63.

x	y	z	r
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	0

Q64.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

Q65.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

Q66.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

Q67.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

Q68.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

Q69.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

Q70.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

Q71.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

Q72.

x	y	z	r
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

Q73.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

Q74.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

Q75.

x	y	z	r
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

Q76.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

Q77.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	1

Q78.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

Q79.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

Q80.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

Q81.

x	y	z	r
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

Q82.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	0

Q83.

x	y	z	r
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1

Q84.

x	y	z	r
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

Q85.

x	y	z	r
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

Q86.

x	y	z	r
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

Q87.

x	y	z	r
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

Q88.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

Q89.

x	y	z	r
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

Q90.

x	y	z	r
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

Q91.

x	y	z	r
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

Q92.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

Q93.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

Q94.

x	y	z	r
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	0

3.2 With don't-care states

Q95.

x	y	z	r
0	0	0	?
0	0	1	1
0	1	0	0
0	1	1	?
1	0	0	1
1	0	1	0
1	1	0	?
1	1	1	?

Q96.

x	y	z	r
0	0	0	1
0	0	1	?
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	?
1	1	0	0
1	1	1	?

Q97.

x	y	z	r
0	0	0	?
0	0	1	?
0	1	0	?
0	1	1	1
1	0	0	0
1	0	1	?
1	1	0	0
1	1	1	1

Q98.

x	y	z	r
0	0	0	0
0	0	1	?
0	1	0	1
0	1	1	?
1	0	0	?
1	0	1	?
1	1	0	0
1	1	1	?

Q99.

x	y	z	r
0	0	0	0
0	0	1	?
0	1	0	1
0	1	1	?
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

Q100.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	?
1	1	1	0

Q101.

x	y	z	r
0	0	0	1
0	0	1	?
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	?
1	1	0	?
1	1	1	?

Q102.

x	y	z	r
0	0	0	?
0	0	1	1
0	1	0	1
0	1	1	?
1	0	0	0
1	0	1	?
1	1	0	0
1	1	1	1

Q103.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	?
1	0	1	1
1	1	0	1
1	1	1	0

Q104.

x	y	z	r
0	0	0	0
0	0	1	1
0	1	0	?
0	1	1	1
1	0	0	1
1	0	1	?
1	1	0	1
1	1	1	?

Q105.

x	y	z	r
0	0	0	?
0	0	1	?
0	1	0	0
0	1	1	?
1	0	0	1
1	0	1	?
1	1	0	1
1	1	1	1

Q106.

x	y	z	r
0	0	0	0
0	0	1	?
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	?
1	1	0	0
1	1	1	0

Q107.

x	y	z	r
0	0	0	0
0	0	1	?
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	?
1	1	0	?
1	1	1	?

Q108.

x	y	z	r
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	?
1	1	0	1
1	1	1	1

Q109.

x	y	z	r
0	0	0	0
0	0	1	?
0	1	0	0
0	1	1	0
1	0	0	?
1	0	1	1
1	1	0	0
1	1	1	1

Q110.

x	y	z	r
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	?
1	1	0	1
1	1	1	0

Q111.

x	y	z	r
0	0	0	?
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	?
1	0	1	1
1	1	0	0
1	1	1	1

Q112.

x	y	z	r
0	0	0	?
0	0	1	?
0	1	0	1
0	1	1	?
1	0	0	?
1	0	1	?
1	1	0	0
1	1	1	1

Q113.

x	y	z	r
0	0	0	0
0	0	1	1
0	1	0	?
0	1	1	0
1	0	0	?
1	0	1	0
1	1	0	?
1	1	1	?

Q114.

x	y	z	r
0	0	0	1
0	0	1	?
0	1	0	1
0	1	1	1
1	0	0	?
1	0	1	0
1	1	0	?
1	1	1	?

Q115.

x	y	z	r
0	0	0	?
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	?
1	0	1	?
1	1	0	1
1	1	1	0

Q116.

x	y	z	r
0	0	0	0
0	0	1	?
0	1	0	1
0	1	1	?
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	?

Q117.

x	y	z	r
0	0	0	?
0	0	1	1
0	1	0	1
0	1	1	?
1	0	0	0
1	0	1	0
1	1	0	?
1	1	1	1

Q118.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	?
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

Q119.

x	y	z	r
0	0	0	?
0	0	1	?
0	1	0	?
0	1	1	?
1	0	0	?
1	0	1	?
1	1	0	0
1	1	1	1

Q120.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	?
1	0	0	0
1	0	1	1
1	1	0	1
1	1	1	1

Q121.

x	y	z	r
0	0	0	?
0	0	1	?
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

Q122.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	?
0	1	1	0
1	0	0	?
1	0	1	1
1	1	0	1
1	1	1	?

Q123.

x	y	z	r
0	0	0	?
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	?
1	1	1	1

Q124.

x	y	z	r
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	?
1	1	1	?

Q125.

x	y	z	r
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	?
1	1	0	0
1	1	1	1

Q126.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	?
1	0	1	1
1	1	0	?
1	1	1	?

Q127.

x	y	z	r
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	?
1	1	1	0

Q128.

x	y	z	r
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	?
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

Q129.

x	y	z	r
0	0	0	1
0	0	1	0
0	1	0	1
0	1	1	?
1	0	0	?
1	0	1	?
1	1	0	0
1	1	1	0

Q130.

x	y	z	r
0	0	0	?
0	0	1	?
0	1	0	1
0	1	1	?
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	?

Q131.

x	y	z	r
0	0	0	?
0	0	1	?
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	?
1	1	0	1
1	1	1	?

Q132.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	?
0	1	1	0
1	0	0	?
1	0	1	1
1	1	0	?
1	1	1	0

Q133.

x	y	z	r
0	0	0	1
0	0	1	?
0	1	0	1
0	1	1	1
1	0	0	?
1	0	1	?
1	1	0	0
1	1	1	?

Q134.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	?
1	1	1	1

Q135.

x	y	z	r
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	?
1	1	1	1

Q136.

x	y	z	r
0	0	0	0
0	0	1	?
0	1	0	?
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

Q137.

x	y	z	r
0	0	0	0
0	0	1	?
0	1	0	0
0	1	1	?
1	0	0	0
1	0	1	1
1	1	0	?
1	1	1	1

Q138.

x	y	z	r
0	0	0	?
0	0	1	?
0	1	0	?
0	1	1	0
1	0	0	?
1	0	1	1
1	1	0	?
1	1	1	1

4 4-input problems

4.1 Without don't-care states

Q139.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

Q140.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

Q141.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

Q142.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

Q143.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

Q144.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

Q145.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

Q146.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	1
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

Q147.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

Q148.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

Q149.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

Q150.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

Q151.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	1
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

Q152.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

Q153.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

Q154.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	1
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

Q155.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

Q156.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

Q157.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

Q158.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

Q159.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

Q160.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

Q161.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

Q162.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

Q163.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

Q164.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

Q165.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	1
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

Q166.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

Q167.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

Q168.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

Q169.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

Q170.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

Q171.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

Q172.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

Q173.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

Q174.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

Q175.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

Q176.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

Q177.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

Q178.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

Q179.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

Q180.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

Q181.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

Q182.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

Q183.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

Q184.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

Q185.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

Q186.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

Q187.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	1
1	0	1	1	0
1	1	0	0	0
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

Q188.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

4.2 With don't-care states

Q189.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	?
0	0	1	0	?
0	0	1	1	?
0	1	0	0	?
0	1	0	1	?
0	1	1	0	?
0	1	1	1	1
1	0	0	0	?
1	0	0	1	1
1	0	1	0	0
1	0	1	1	?
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

Q190.

w	x	y	z	r
0	0	0	0	?
0	0	0	1	1
0	0	1	0	?
0	0	1	1	?
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	?
1	0	0	0	?
1	0	0	1	0
1	0	1	0	?
1	0	1	1	?
1	1	0	0	1
1	1	0	1	1
1	1	1	0	?
1	1	1	1	?

Q191.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	?
0	0	1	0	0
0	0	1	1	?
0	1	0	0	?
0	1	0	1	1
0	1	1	0	?
0	1	1	1	?
1	0	0	0	?
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

Q192.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	0
0	0	1	0	?
0	0	1	1	0
0	1	0	0	0
0	1	0	1	?
0	1	1	0	?
0	1	1	1	1
1	0	0	0	?
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	?
1	1	0	1	1
1	1	1	0	0
1	1	1	1	?

Q193.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	?
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	?
1	0	0	0	?
1	0	0	1	?
1	0	1	0	1
1	0	1	1	0
1	1	0	0	?
1	1	0	1	?
1	1	1	0	0
1	1	1	1	1

Q194.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	?
1	0	0	0	?
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	?

Q195.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	?
0	1	0	0	1
0	1	0	1	1
0	1	1	0	?
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	?

Q196.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	?
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	?
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	?
1	1	1	0	?
1	1	1	1	1

Q197.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	?
0	1	0	0	?
0	1	0	1	?
0	1	1	0	1
0	1	1	1	?
1	0	0	0	?
1	0	0	1	?
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

Q198.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	?
0	1	1	0	1
0	1	1	1	0
1	0	0	0	?
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

Q199.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	?
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	?
1	0	0	1	1
1	0	1	0	?
1	0	1	1	?
1	1	0	0	1
1	1	0	1	?
1	1	1	0	0
1	1	1	1	?

Q200.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	?
0	0	1	0	?
0	0	1	1	?
0	1	0	0	?
0	1	0	1	?
0	1	1	0	?
0	1	1	1	?
1	0	0	0	?
1	0	0	1	?
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	?
1	1	1	0	1
1	1	1	1	1

Q201.

w	x	y	z	r
0	0	0	0	?
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	?
1	0	1	0	0
1	0	1	1	?
1	1	0	0	?
1	1	0	1	1
1	1	1	0	?
1	1	1	1	1

Q202.

w	x	y	z	r
0	0	0	0	?
0	0	0	1	?
0	0	1	0	0
0	0	1	1	?
0	1	0	0	?
0	1	0	1	?
0	1	1	0	1
0	1	1	1	?
1	0	0	0	?
1	0	0	1	1
1	0	1	0	0
1	0	1	1	1
1	1	0	0	1
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

Q203.

w	x	y	z	r
0	0	0	0	?
0	0	0	1	0
0	0	1	0	1
0	0	1	1	?
0	1	0	0	1
0	1	0	1	0
0	1	1	0	?
0	1	1	1	1
1	0	0	0	?
1	0	0	1	1
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

Q204.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	?
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	?
0	1	1	0	?
0	1	1	1	0
1	0	0	0	0
1	0	0	1	?
1	0	1	0	1
1	0	1	1	?
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	?

Q205.

w	x	y	z	r
0	0	0	0	?
0	0	0	1	1
0	0	1	0	?
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	?
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	?
1	1	1	0	?
1	1	1	1	?

Q206.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	?
0	0	1	1	?
0	1	0	0	1
0	1	0	1	0
0	1	1	0	?
0	1	1	1	1
1	0	0	0	?
1	0	0	1	?
1	0	1	0	0
1	0	1	1	?
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

Q207.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	?
1	0	0	1	0
1	0	1	0	?
1	0	1	1	0
1	1	0	0	?
1	1	0	1	0
1	1	1	0	?
1	1	1	1	1

Q208.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	0
0	1	1	0	?
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	?
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	0
1	1	1	1	1

Q209.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	?
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	?
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	?
1	0	1	1	0
1	1	0	0	?
1	1	0	1	?
1	1	1	0	?
1	1	1	1	1

Q210.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	1
0	1	1	0	?
0	1	1	1	?
1	0	0	0	?
1	0	0	1	?
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	?
1	1	1	0	0
1	1	1	1	0

Q211.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	?
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	?
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	1
1	1	0	1	?
1	1	1	0	1
1	1	1	1	1

Q212.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	?
0	1	1	1	1
1	0	0	0	0
1	0	0	1	1
1	0	1	0	?
1	0	1	1	?
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

Q213.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	?
0	0	1	0	0
0	0	1	1	1
0	1	0	0	1
0	1	0	1	?
0	1	1	0	?
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	?
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

Q214.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	?
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	?
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

Q215.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	?
0	0	1	1	?
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	?
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	?
1	1	0	0	?
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

Q216.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	?
0	1	0	0	?
0	1	0	1	?
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	?
1	0	1	1	1
1	1	0	0	1
1	1	0	1	0
1	1	1	0	?
1	1	1	1	0

Q217.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	?
0	0	1	0	0
0	0	1	1	?
0	1	0	0	0
0	1	0	1	0
0	1	1	0	?
0	1	1	1	?
1	0	0	0	1
1	0	0	1	?
1	0	1	0	1
1	0	1	1	?
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	?

Q218.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	?
1	0	0	1	1
1	0	1	0	?
1	0	1	1	?
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	?

Q219.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	?
0	1	0	0	1
0	1	0	1	?
0	1	1	0	?
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0
1	0	1	0	?
1	0	1	1	0
1	1	0	0	?
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

Q220.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	?
0	0	1	1	?
0	1	0	0	?
0	1	0	1	?
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	?
1	1	0	1	?
1	1	1	0	0
1	1	1	1	0

Q221.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	1
0	0	1	1	0
0	1	0	0	0
0	1	0	1	?
0	1	1	0	?
0	1	1	1	0
1	0	0	0	?
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

Q222.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	?
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	?
1	0	1	1	0
1	1	0	0	0
1	1	0	1	?
1	1	1	0	?
1	1	1	1	?

Q223.

w	x	y	z	r
0	0	0	0	?
0	0	0	1	1
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	?
0	1	1	0	0
0	1	1	1	?
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	0
1	1	0	1	?
1	1	1	0	?
1	1	1	1	0

Q224.

w	x	y	z	r
0	0	0	0	?
0	0	0	1	?
0	0	1	0	1
0	0	1	1	0
0	1	0	0	?
0	1	0	1	?
0	1	1	0	?
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	?
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	?
1	1	1	1	0

Q225.

w	x	y	z	r
0	0	0	0	?
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	0
0	1	1	0	0
0	1	1	1	?
1	0	0	0	0
1	0	0	1	1
1	0	1	0	?
1	0	1	1	1
1	1	0	0	?
1	1	0	1	0
1	1	1	0	1
1	1	1	1	?

Q226.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	0
0	0	1	0	?
0	0	1	1	?
0	1	0	0	?
0	1	0	1	0
0	1	1	0	0
0	1	1	1	?
1	0	0	0	?
1	0	0	1	?
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	0

Q227.

w	x	y	z	r
0	0	0	0	?
0	0	0	1	0
0	0	1	0	?
0	0	1	1	?
0	1	0	0	1
0	1	0	1	0
0	1	1	0	?
0	1	1	1	0
1	0	0	0	1
1	0	0	1	0
1	0	1	0	1
1	0	1	1	0
1	1	0	0	1
1	1	0	1	?
1	1	1	0	0
1	1	1	1	1

Q228.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	1
0	1	0	0	?
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	?
1	0	0	1	0
1	0	1	0	0
1	0	1	1	?
1	1	0	0	?
1	1	0	1	?
1	1	1	0	1
1	1	1	1	1

Q229.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	?
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	0
1	0	0	1	?
1	0	1	0	?
1	0	1	1	0
1	1	0	0	1
1	1	0	1	0
1	1	1	0	?
1	1	1	1	1

Q230.

w	x	y	z	r
0	0	0	0	?
0	0	0	1	?
0	0	1	0	0
0	0	1	1	0
0	1	0	0	?
0	1	0	1	?
0	1	1	0	0
0	1	1	1	?
1	0	0	0	?
1	0	0	1	?
1	0	1	0	1
1	0	1	1	?
1	1	0	0	0
1	1	0	1	1
1	1	1	0	?
1	1	1	1	?

Q231.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	?
0	0	1	1	1
0	1	0	0	?
0	1	0	1	?
0	1	1	0	0
0	1	1	1	?
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	0
1	1	0	1	?
1	1	1	0	1
1	1	1	1	0

Q232.

w	x	y	z	r
0	0	0	0	?
0	0	0	1	?
0	0	1	0	0
0	0	1	1	0
0	1	0	0	?
0	1	0	1	0
0	1	1	0	1
0	1	1	1	0
1	0	0	0	?
1	0	0	1	?
1	0	1	0	?
1	0	1	1	0
1	1	0	0	?
1	1	0	1	1
1	1	1	0	0
1	1	1	1	?

Q233.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	0
0	0	1	1	?
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	?
1	0	0	0	1
1	0	0	1	?
1	0	1	0	?
1	0	1	1	0
1	1	0	0	?
1	1	0	1	1
1	1	1	0	0
1	1	1	1	?

Q234.

w	x	y	z	r
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0
0	1	0	0	1
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	?
1	0	0	1	0
1	0	1	0	?
1	0	1	1	?
1	1	0	0	0
1	1	0	1	0
1	1	1	0	1
1	1	1	1	1

Q235.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	?
0	1	0	1	0
0	1	1	0	0
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	?
1	1	0	0	?
1	1	0	1	1
1	1	1	0	0
1	1	1	1	0

Q236.

w	x	y	z	r
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	?
0	1	0	0	?
0	1	0	1	0
0	1	1	0	?
0	1	1	1	?
1	0	0	0	?
1	0	0	1	1
1	0	1	0	?
1	0	1	1	0
1	1	0	0	?
1	1	0	1	?
1	1	1	0	?
1	1	1	1	1

Q237.

w	x	y	z	r
0	0	0	0	?
0	0	0	1	?
0	0	1	0	0
0	0	1	1	0
0	1	0	0	1
0	1	0	1	?
0	1	1	0	0
0	1	1	1	?
1	0	0	0	0
1	0	0	1	0
1	0	1	0	?
1	0	1	1	1
1	1	0	0	1
1	1	0	1	0
1	1	1	0	?
1	1	1	1	1

Q238.

w	x	y	z	r
0	0	0	0	?
0	0	0	1	1
0	0	1	0	1
0	0	1	1	?
0	1	0	0	0
0	1	0	1	1
0	1	1	0	0
0	1	1	1	1
1	0	0	0	?
1	0	0	1	0
1	0	1	0	0
1	0	1	1	1
1	1	0	0	?
1	1	0	1	0
1	1	1	0	?
1	1	1	1	0