1.

r = rain

u = umbrella

t = temperature in F

j = jacket

r = u

r ^ (t < 70) = j

2. a.

a,b,c,d

b.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Rows | a | b | c | d | (a | b) | (a | c) | (a | b) & (a | c) | (a | b) & (a | c) & d |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| 3 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| 4 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 |
| 5 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| 6 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 |
| 7 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 8 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |
| 9 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 10 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| 11 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| 12 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 13 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| 14 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 15 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Row# | a | b | c | d | P | Pa | Pb | Pc | Pd |
| 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 |
| 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 3 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 |
| 4 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 5 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 |
| 6 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 7 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 |
| 8 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 9 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| 10 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 11 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| 12 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| 14 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

c.

a is crucial when (b,c,d) are:

(0,0,1), (0,1,1), (1,0,1)

b is crucial when (a,c,d) are:

(0,1,1)

c is crucial when (a,b,d) are:

(0,1,1)

d is crucial in all cases, or when (a,b,c) are:

(0,1,1), (1,0,0), (1,0,1), (1,1,0), (1,1,1)

d.

Numbers listed are row numbers from the truth table.

Pa = (3, 11); (5, 13); (7, 15)

Pb = (9, 13)

Pc = (9, 11)

Pd = (1, 2); (3, 4); (5, 6); (7, 8); (9, 10)