1. Construct a truth table for the following:

a. *(x + y)(x + z)(x' + z)*

**Ans**

| x | y | z | x' | x + y | x + z | x' + z | (x + y)(x + z)(x + z) |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 |

*2. Show that x = xy + xy '*

*a. Using truth tables*

| x | y | y' | xy | xy' | xy + xy' |
| --- | --- | --- | --- | --- | --- |
| 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 1 | 0 | 1 |

*b. Using Boolean identities*

x = xy + xy*'* = x(y+y*'*) # Distributive Law

= x(1) # Inverse Law

= x # Identity Law

**Ans** ∴ x = xy + xy*'*

2. Given the function: F*(x,y,z)= xy'z + x'y'z + xyz*

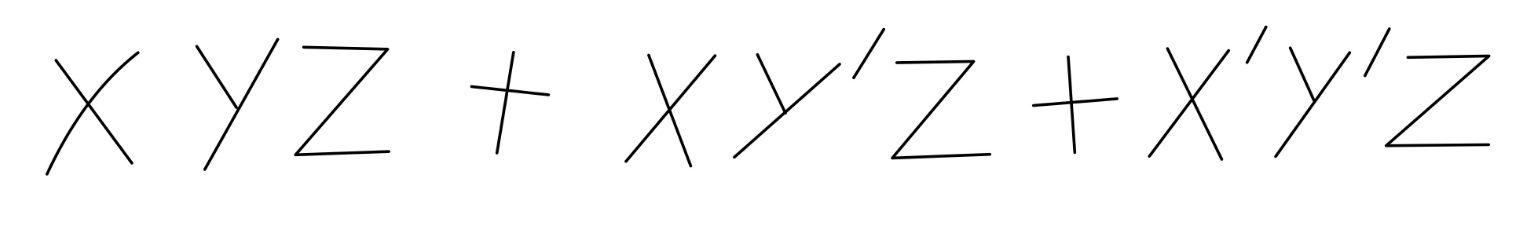
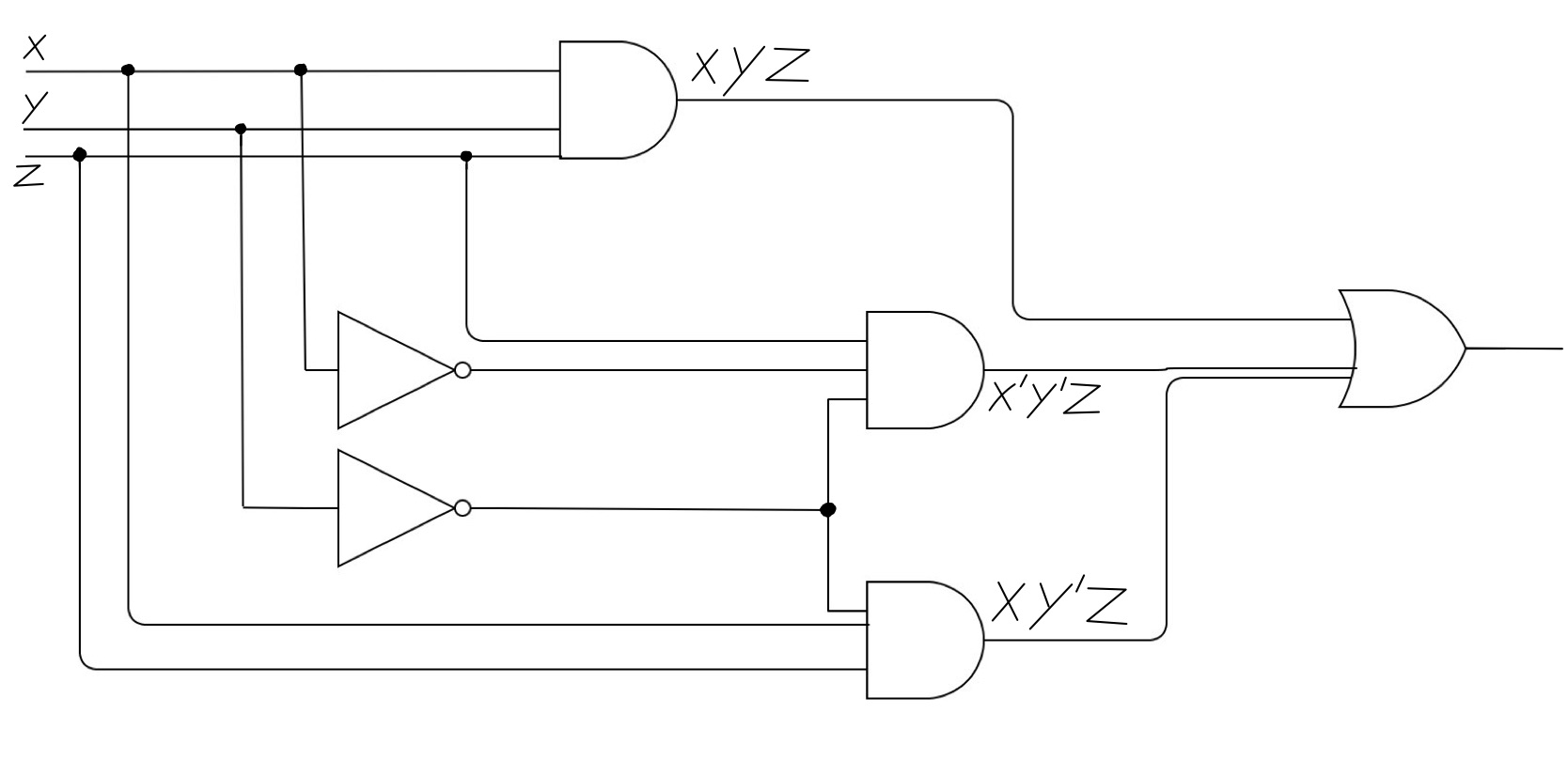
a. List the truth table for F.

**Ans**

| x | y | z | x' | y' | xyz | xy'z | x'y'z | xy'z + x'y'z + xyz |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |

b. Draw the logic diagram using the original Boolean expression

**Ans**



c. Simplify the expression using Boolean algebra and identities.

**Ans**

F(x,y,z) = xy'z + x'y'z + xyz # Idempotent Law

= z(xy' + x'y' + xy) # Distributive Law

= z(x(y + y') + x'y') # Commutative & Distributive Laws

= z(x(1) + x'y') # Inverse Law

= z(x + x'y') # Identity Law

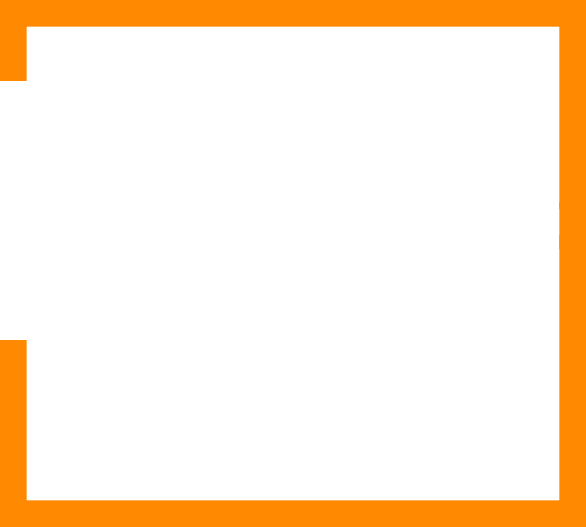
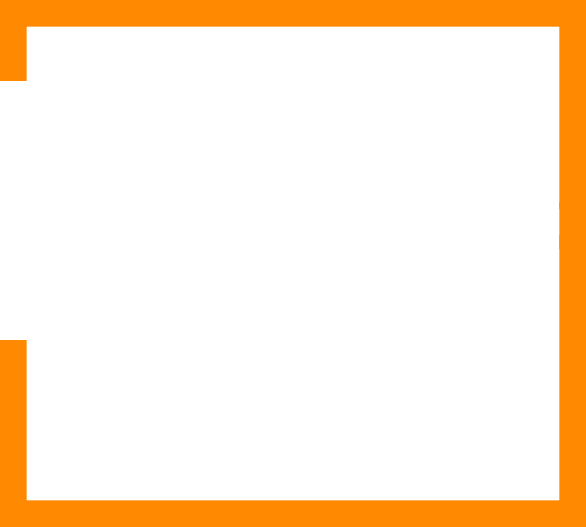
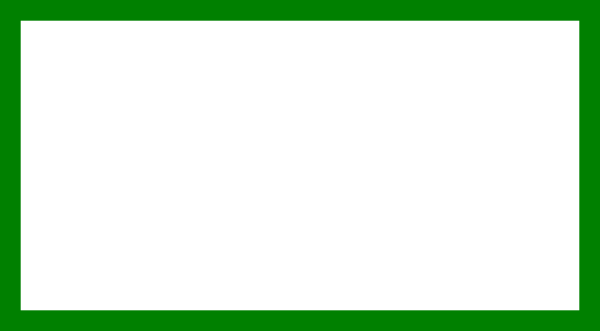
= z((x + x')(x + y')) # Distributive Law

= z((1)(x + y')) # Inverse Law

= z(x + y') # Identity Law

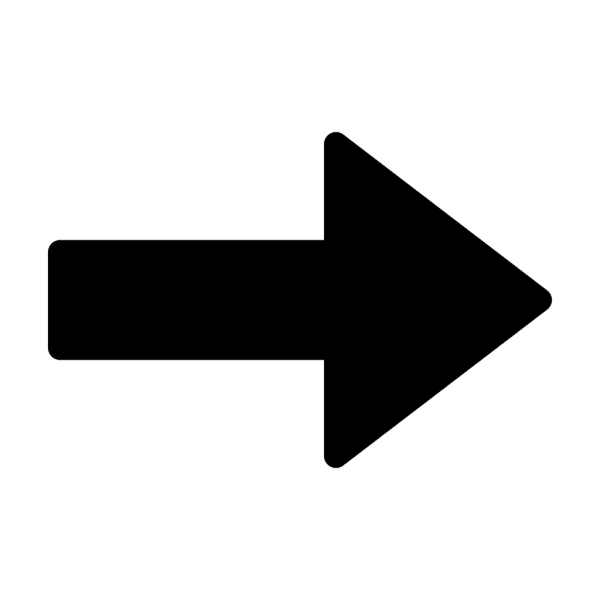
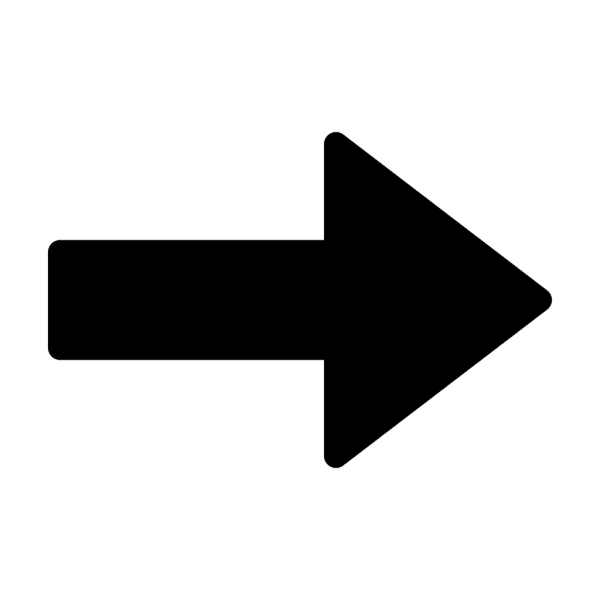
= xz + y'z # Distributive Law

d. Simplify the expression using KMap

**Ans**

| x **\\** yz | 00 | 01 | 11 | 10 |
| --- | --- | --- | --- | --- |
| 0 | 0 | 1 | 0 | 0 |
| 1 | 0 | 1 | 1 | 0 |

xy*'*z xy*'z*

x*'*y*'*z xyz

y'z + xz —> y'z + xz # Simplified

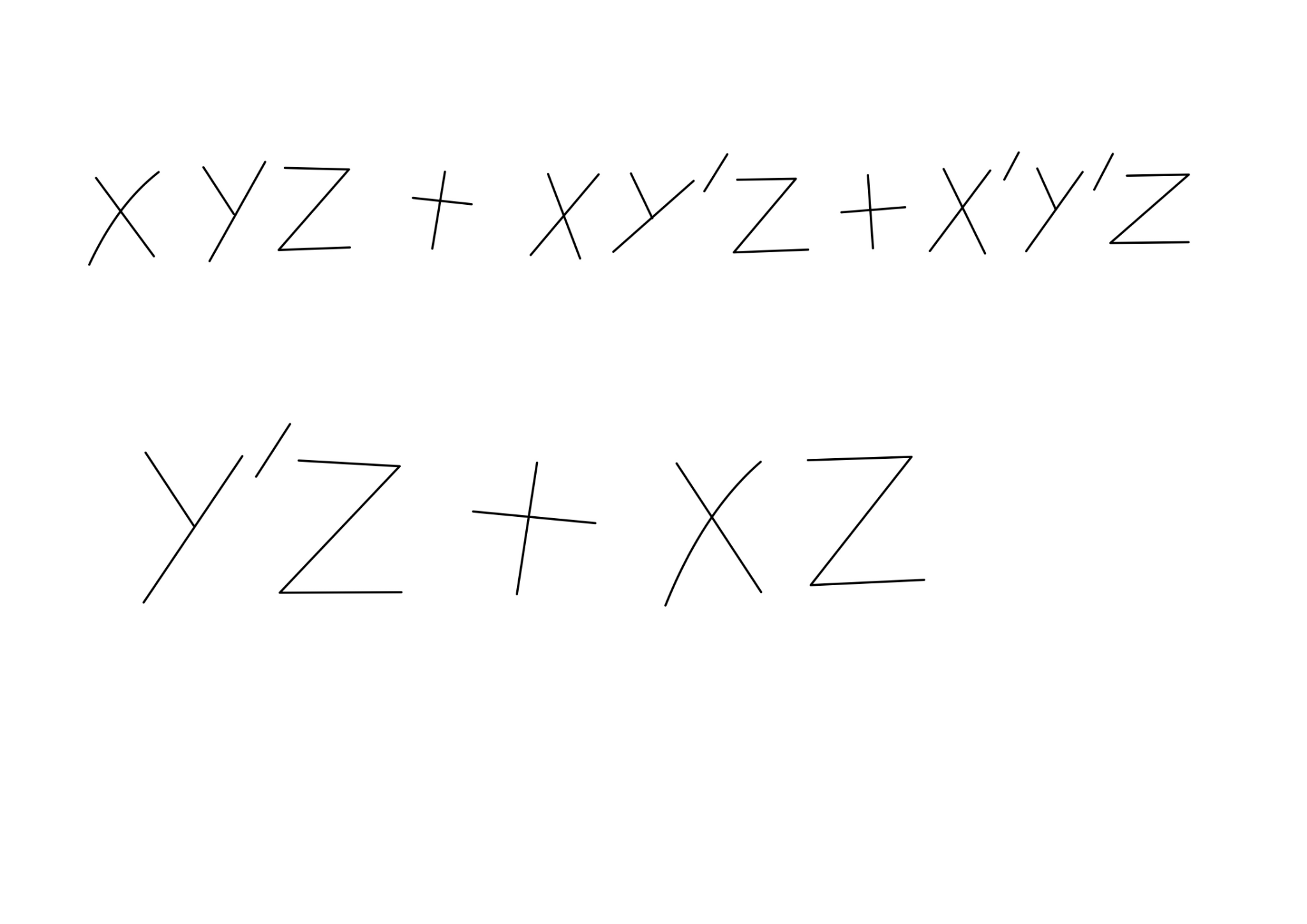
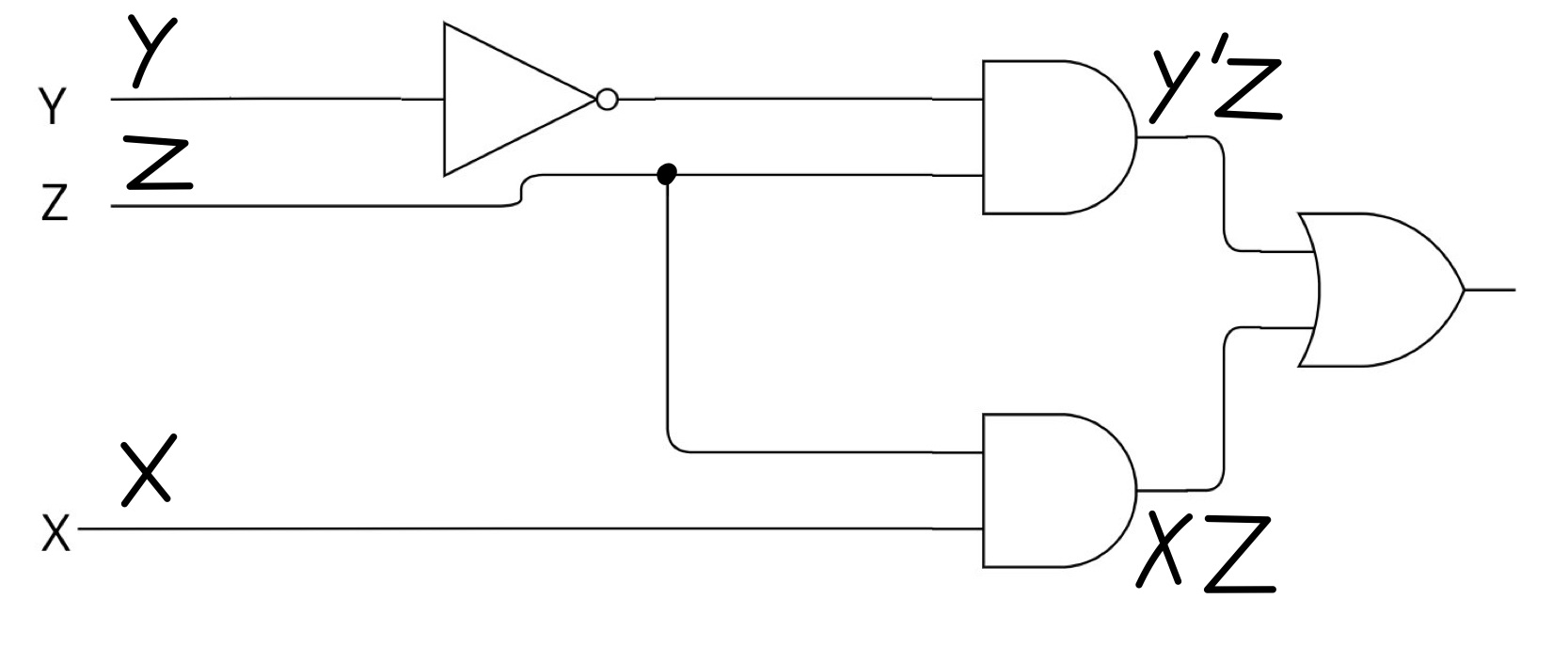
e. List the truth table for your answer in Part d.

**Ans**

| x | y | z | y' | xz | y'z | y'z + xz |
| --- | --- | --- | --- | --- | --- | --- |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 | 1 | 1 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 | 1 | 0 | 1 |

f. Draw the logic diagram for the simplified expression in Part d.

**Ans**



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