| 1 | 2 | 3 | grade |
|---|---|---|---|
| | | | |

**Discrete Systems** **Quiz 12.** Student name Yuta Nemoto Student ID s1240234

1. Find the values, if any, of the Boolean variable x that satisfy the following equations.

   (a) $x * 1 = 0$

   (b) $x * 1 = x$

   (c) $x + x = 0$

   (d) $x * x' = 1$

(a) $x = 0$

(b) $x = 0, 1$

(c) $x = 0$

| $x$ | $x+x$ |
|---|---|
| 0 | 0 |
| 1 | 1 |

(d)

| $x$ | $x'$ | $x * x'$ |
|---|---|---|
| 0 | 1 | 0 |
| 1 | 0 | 0 |

no proper values for $x$

2. Find the complete sum-of-products expansions of the following Boolean functions

   (a) $F(x, y, z) = x$;

   (b) $F(x, y, z) = x + y + z$;

   (c) $F(x, y, z) = xy'$.

(a)

| $x$ | $y$ | $z$ | $F$ |
|---|---|---|---|
| 1 | 1 | 1 | 1 |
| 1 | 1 | 0 | 1 |
| 1 | 0 | 1 | 1 |
| 1 | 0 | 0 | 1 |
| 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 0 |

(b)

| $x$ | $y$ | $z$ | $F$ |
|---|---|---|---|
| 1 | 1 | 1 | 1 |
| 1 | 1 | 0 | 1 |
| 1 | 0 | 1 | 1 |
| 1 | 0 | 0 | 1 |
| 0 | 1 | 1 | 1 |
| 0 | 1 | 0 | 1 |
| 0 | 0 | 1 | 1 |
| 0 | 0 | 0 | 0 |

(c)

| $x$ | $y$ | $z$ | $F$ |
|---|---|---|---|
| 1 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 |
| 1 | 0 | 1 | 1 |
| 1 | 0 | 0 | 1 |
| 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 0 |

3. Using the basic logic gates design a circuit that takes three inputs $x, y, z$ and produces a value 1 if and only if the input for $x$ is 1 and exactly one of the inputs for $y$ and $z$ is 1.

| $x$ | $y$ | $z$ | result |
|---|---|---|---|
| 1 | 1 | 1 | 0 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 1 |
| 1 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 |