

HOMWORK 1 - solutions

①

X1	X2	X3	Qa
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	1

FUNCTION:

$$Q_a = \overline{X_1 \cdot X_2 \cdot X_3}$$

② SIMPLER CIRCUIT :



$$Q_b = X_1 + X_2 + X_3$$

③ CODE FOR Qa :

```
ENTITY MyFirstFunction IS
```

```
  PORT (X1, X2, X3: IN BIT;
```

```
        Qa: OUT BIT);
```

```
END MyFirstFunction
```

```
ARCHITECTURE Difficult OF MyFirstFunction IS
```

```
  BEGIN
```

```
    Qa <= (NOT (NOTX1 AND NOTX2 AND NOTX3));
```

```
  END Difficult;
```

• CODE FOR "Qb": (SAME ENTITY!)

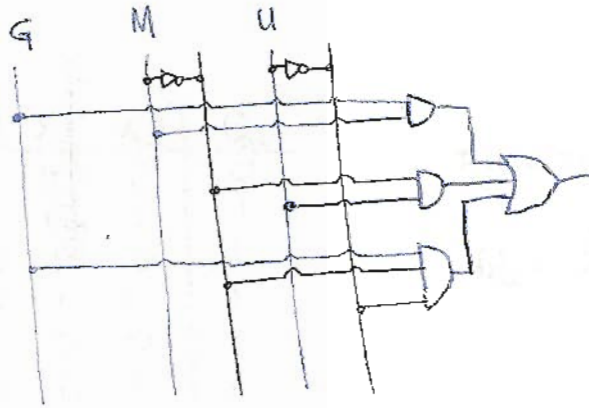
```
ARCHITECTURE EasyOne OF MyFirstFunction IS
```

```
  BEGIN
```

```
    Qa <= X1 OR X2 OR X3;
```

```
  END EasyOne;
```

$$4. f = gm\bar{m}u + g\bar{m}u$$



TRUTH TABLE:

g	m	u	gm	$\bar{m}u$	$g\bar{m}u$	f
0	0	0	0	0	0	0
0	0	1	0	1	0	1
0	1	0	0	0	0	0
0	1	1	0	0	0	0
1	0	0	0	0	1	1
1	0	1	0	1	0	1
1	1	0	1	0	0	1
1	1	1	1	0	0	1

5.

5.a. 7404 is a 14-pin integrated circuit containing 6 inverters. It is also called a "hex inverter".

5.b. 4.75V

5.c. 5.25V

5.d. Between 0 and 0.8V
(depending on the particular datasheet, these values vary: 0.2 to 0.4V are also acceptable)

5.e. 8ns (also 15ns).

↑ depends on datasheet!

5.f. No. Because the $I_{OH} = -0.4\text{mA}$ for both series (54 and 74).

6. EXTRA CREDIT.

Possible answers:

① Use a buffer-IC

② Use a voltage follower (op-amp) with low ($< 0.4\text{mA}$) input current.

(Student should present answers with more detail—maybe specify which chips to use, draw circuit.)