LSP Exam 2019 – 题目与答案

CVUT FEL (CVUT) – České vysoké učení technické v Praze | Czech Technical University in Prague

中文版 | English | Čeština

本文件包含官方答案 (Official Answers Included)

题目2: RS锁存器电路仿真　常考

题目: 输入A, B, C在时刻t0, t1, t2, t3的值如下，写出Q输出值。 **[English]** Given inputs A, B, C values at times t0, t1, t2, t3 as shown, write the Q output value.

```
A = ..0..|..1..|..1..|..1..|
B = ..0..|..0..|..0..|..1..|
C = ..1..|..1..|..0..|..0..|

t0   t1   t2   t3
```

答案

```
Q = ...1...|…0….|…0….|…1.…|
```

题目3: 香农展开　常考

题目: 将函数 `Q=f(A,B,C,Q)` 分解为： **[English]** Decompose the function Q=f(A,B,C,Q) into:

```
Q = (not Q and f0(A,B,C)) or (Q and f1(A,B,C))
```

解答过程

Step 1: 令 Q=0，求 f0

```
f0 := f(A,B,C,'0')
   := (A   B) · ('0' + (B   C))
   := (A   B) · (B   C)
```

Step 2: 令 Q=1，求 f1

```
f1 := f(A,B,C,'1')
   := (A   B) · ('1' + (B   C))
   := (A   B) · '1'
   := (A   B)
```

f0 卡诺图: (A ≡ B) · (B ≠ C)

```
      C=0  C=1
AB=00  0    1
AB=01  0    0
AB=11  1    0
AB=10  0    0
```

圈出: (ABC) + (ABC) = (A ≡ B)(B ≠ C)

f1 卡诺图: (A ≡ B)

```
      C=0  C=1
AB=00  1    1
AB=01  0    0
AB=11  1    1
AB=10  0    0
```

圈出: (AB) + (AB) = (A ≡ B) = A XNOR B

题目5: 等价逻辑函数　常考

题目: 标记所有与其他函数等价的逻辑函数: **[English]** Mark all logic functions that are equivalent to other functions:

```
f1 <= (A xor C) or (A and not C);
f2 <= (B or C) and (not A or B or C);
f3 <= ((C and not B) or (B and A));
f4 <= (A or C) and (not A or not C);
f5 <= (A and not B) xor (A and C);
f6 <= (A and not C) or (C and not A);
```

答案

用卡诺图分析每个函数:

f4 的卡诺图:

```
(A or C) and (not A or not C)
= (A + C) · (A + C)
= A·A + A·C + C·A + C·C
= A·C + A·C
= A   C
```

f6 的卡诺图:

```
(A and not C) or (C and not A)
= A·C + C·A
= A   C
```

结论: f4 ≡ f6 (都是 A XOR C)

真值表速查

A ⊕ C (XOR) 真值表

A	C	A⊕C
0	0	0

A	C	A⊕C
0	1	1
1	0	1
1	1	0

A ≡ B (XNOR) 真值表

A	B	A≡B
0	0	1
0	1	0
1	0	0
1	1	1

知识点总结

香农展开解题步骤

1. **识别反馈变量**: 找出函数中既是输入又是输出的变量 (如Q)
2. **代入Q=0**: 得到 f0(其他变量)
3. **代入Q=1**: 得到 f1(其他变量)
4. **画卡诺图**: 分别画出f0和f1
5. **验证**: Q = Q·f0 + Q·f1

等价函数判断技巧

1. 先化简每个表达式
2. 画卡诺图比较
3. 注意XOR和XNOR的等价形式:
   - A ⊕ C = A·C + A·C
   - A ≡ C = A·C + A·C = (A ⊕ C)