編譯原理教材第 63 頁 3 6 7 9 12 題

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1 P63 第 3 題

1.1 使用 C 或是 Pascal 的语言编写过程 GetChar、GetBC 和 Concat

1.1.1 GetChar

```
void Getchar()
{
  if(flag == 0)
  {
    if((fp = fopen("1.txt","r")) == NULL)
    {
      printf("cannot open this file\n");
      exit(0);
    }
  }
  flag++;

  character = fgetc(fp);

  if(character == EOF) {
    fclose(fp);
  }
}
```

1.1.2 GetBC

```
void Getbc()
{
  if(character == EOF)
    return;
  while(character == ' ' || character == '\n' || character == '\t')
   Getchar();
}
```

1.1.3 Concat

```
void Concat()
{
  if(i == 0)
  {
    token[0] = character;
    token[1] = '/0';
    i = 1;
  }
  else
  {
    token[i] = character;
    i++;
    token[i] = '/0';
  }
}
```

2 P63 第 6 题

2.1 令 A、B 和 C 是任意正规式，证明以下关系成立

$$A \mid A = A$$
$$(A^\star)^\star = A^\star$$
$$A^\star = \varepsilon \mid AA^\star$$
$$(AB)^\star A = A(BA)^\star$$

$(A \mid B)^\star = (A^\star B^\star)^\star = (A^\star \mid B^\star)^\star$

$A = b \mid aA$ 当且仅当 $A = a^\star b$

2.1.1 $A \mid A = A$

抽取律

$L(A \mid A) = L(A) \cup L(A) = L(A)$

2.1.2 $(A^\star)^\star = A^\star$

证：

$$
\begin{aligned}
& L(A^\star \cdot A^\star \cdots A^\star) = L(A^\star) \\
& \iff L(A \cdot A \cdot A \cdots A) = L(A \cdots A) \\
& \iff L(A^\star) = L((A^\star)^\star)
\end{aligned}
$$

2.1.3 $A^\star = \varepsilon \mid AA^\star$

证：

$$
\begin{aligned}
& L(\varepsilon \mid AA^\star) = L(\varepsilon) \cup L(A)L(A^\star) \\
& = L(\varepsilon) \cup L(A)(L(A))^\star \\
& = L(\varepsilon) \cup L(A) \cup (L(A)) \cup \cdots \cup \cdots \\
& = (L(A))^\star = L(A^\star)
\end{aligned}
$$

综合上述，所以原式成立。

2.1.4 $(AB)^\star A = A(BA)^\star$

证：

$$
\begin{aligned}
& ((AB^0) \mid (AB^1) \cdots ((AB)^N)) \cdot A = \varepsilon A \mid A \cdot (AB)^1 \cdots \\
& = A \cdot \varepsilon \mid A(BA)^1 \mid \cdots \\
& = A(BA)^\star
\end{aligned}
$$

2.1.5 $(A \mid B)^\star = (A^\star B^\star)^\star = (A^\star \mid B^\star)^\star$

证：

证明 $(A \mid B)^\star = (A^\star B^\star)^\star$

$L(A) \subseteq L(A^\star)L(B^\star)$

$L(B) \subseteq L(A^\star)L(B^\star)$

$L(A) \cup L(B) \subseteq L(A^\star)L(B^\star)$

$(L(A) \cup L(B))^\star \subseteq (L(A^\star)L(B^\star))^\star$

又 $\because L(A) \subseteq L(A) \cup L(B)$

$\quad L(B) \subseteq L(A) \cup L(B)$

$\therefore L(A)^\star \cdot L(B^\star) \subseteq ((L(A) \cup L(B))^\star)^2$

$\quad L(A)^\star \cdot L(B^\star) \subseteq (L(A) \cup L(B))^\star$

$\quad (L(A)^\star \cdot L(B^\star))^\star \subseteq (L(A) \cup L(B))^\star$

$\therefore (L(A) \cdot L(B))^\star = (L(A^\star) \cup L(B^\star))^\star$

$\therefore (A \mid B)^\star = (A^\star B^\star)^\star$ **成立**

证明 $(A \mid B)^\star = (A^\star \mid B^\star)^\star$

$L(A) \subseteq L(A^\star) \cup L(B^\star)$

$L(B) \subseteq L(A^\star) \cup L(B^\star)$

$L(A) \cup L(B) \subseteq L(A^\star) \cup L(B^\star)$

$(L(A) \cup L(B) \subseteq (L(A^\star))^\star \cup L(B^\star))^\star$

又 $\because L(A^\star) \subseteq (L(A) \cup L(B))^\star$

$\quad L(B^\star) \subseteq (L(A) \cup L(B))^\star$

$(L(A^\star) \cup L(B^\star))^\star \subseteq (L(A) \cup L(B))^\star$

综合上述 $\therefore (A \mid B)^\star = (A^\star \mid B^\star)^\star$ **成立**

所以原式成立

2.1.6 $A = b \mid aA$ 当且仅当 $A = a^\star b$

若 $A = a^\star b$ 则 $A = b \mid aA$

$$
\begin{aligned}
L(A) &= L(a)^{\star}L(b) \\
&= L(\varepsilon)L(b) \cup L(a)^{\star}L(b) \\
&= L(b) \cup L(a)^{\star}L(b) \\
&= L(b) \cup L(a)L(a)^{\star}L(b) \\
&= L(b \mid aA)
\end{aligned}
$$

再证当 $A = b \mid aA$ 则 $A = a^{\star}b$

$$
\begin{aligned}
L(A) &= L(b) \cup L(aA) \\
&= L(b)L(\varepsilon) \cup L(a)L(A) \\
&= L(a)^{\star}L(b)
\end{aligned}
$$

综上原式成立

3 P63 第 7 题

3.1 构造下列正则相应的 DFA

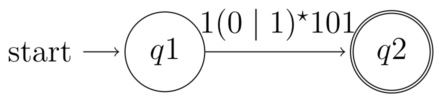
$1(0 \mid 1)^{\star}101$

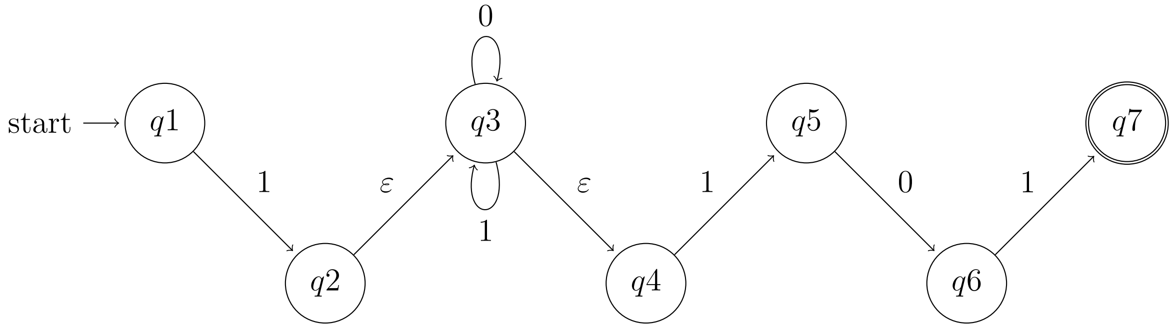
$1(1010^{\star}11(010)^{\star}1)^{\star}0$

$0^{\star}10^{\star}10^{\star}10^{\star}$

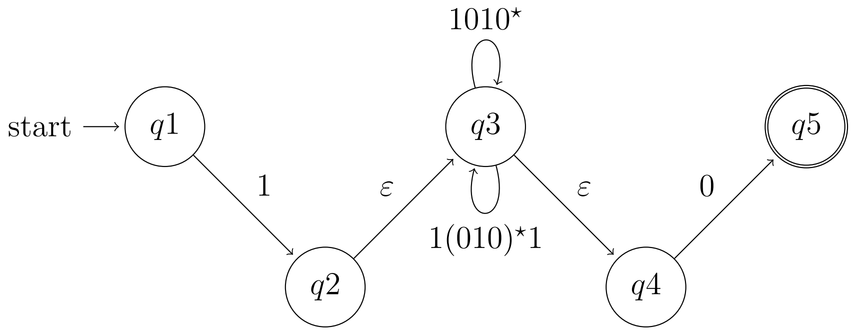
$(00 \mid 11)^{\star}((01 \mid 10)(00 \mid 11)^{\star}(01 \mid 10)(00 \mid 11)^{\star})^{\star}$

3.1.1 $1(0 \mid 1)^{\star}101$

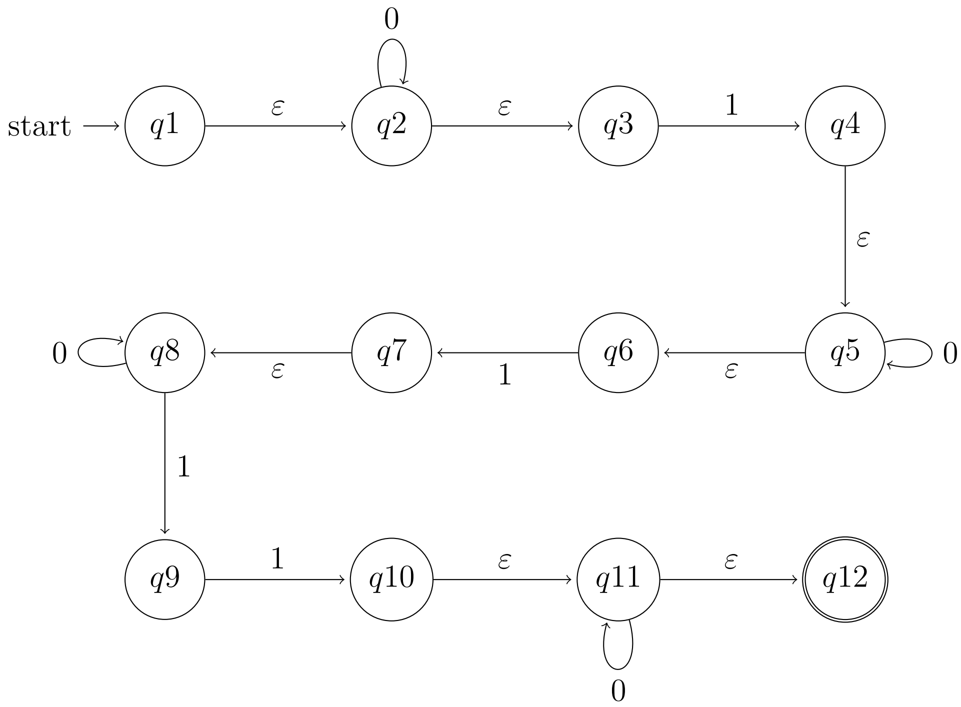




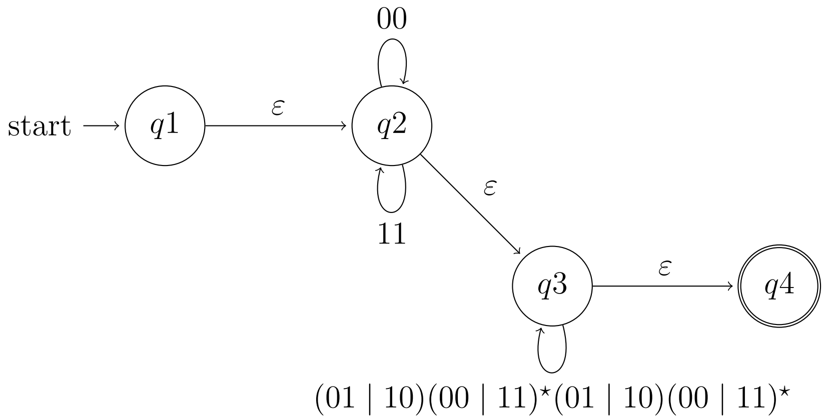
3.1.2 $1(1010^\star 11(010)^\star 1)^\star 0$



3.1.3 $0^\star 10^\star 10^\star 10^\star$



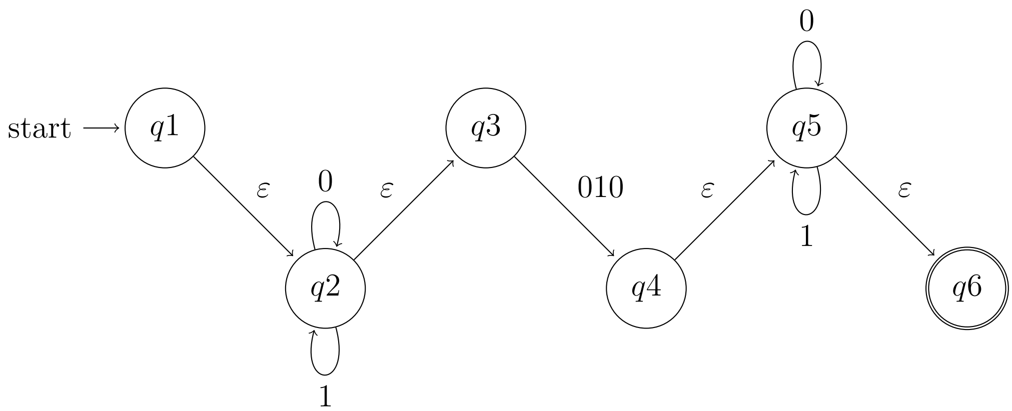
3.1.4 $(00 \mid 11)^{\star}((01 \mid 10)(00 \mid 11)^{\star}(01 \mid 10)(00 \mid 11)^{\star})^{\star}$



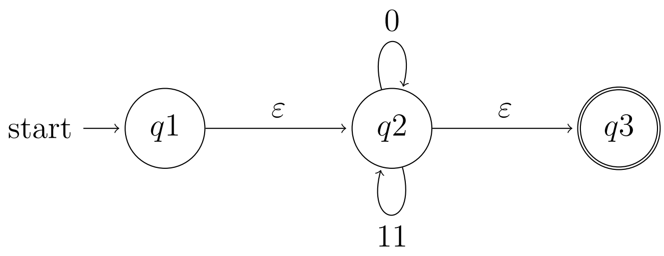
4 P63 第 9 题

对下面情况给出 DFA 及正规表达式。

4.1 $0, 1$ 上的含有子串 010 的所有串

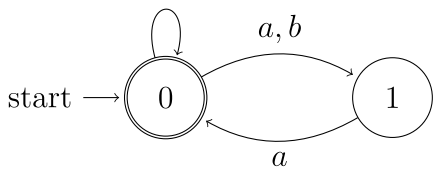


4.2 $0, 1$ 上不含子串 010 的所有串



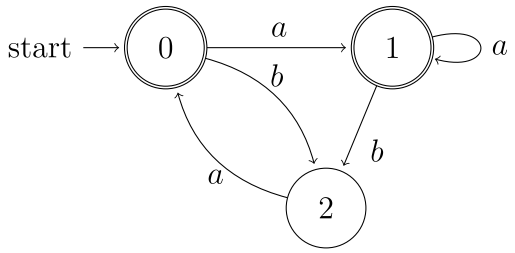
5 P63 第 12 题

5.1 a 确定化与最小化

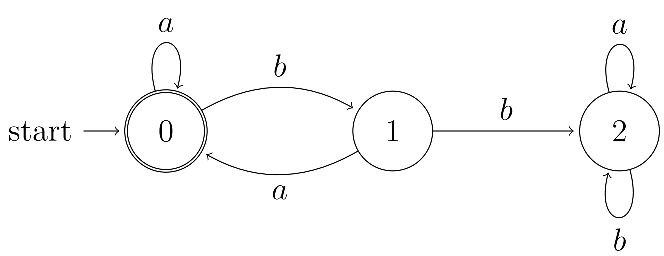


解：

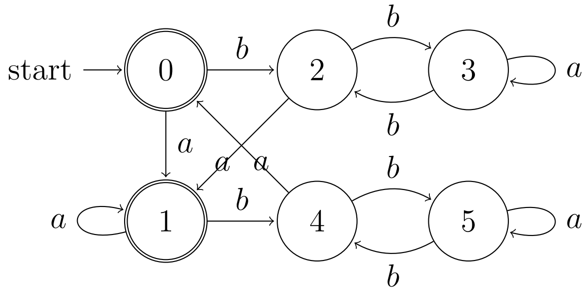
确定化



最小化



5.2 b 确定化与最小化



确定化

显然此 NFA 已确定化。

最小化