

1. (45 %) Write regular expressions for the following character sets, or give reasons why no regular expression can be written:

(a) (5 %) All strings of lowercase letters that begin and end in a.

$$\text{letter} = a | b | \dots | z$$

$$R.E = a(\text{letter})^*a \quad | \quad a \quad \rightarrow \text{自己也符合條件}$$

(b) (5 %) All strings of lowercase letters that either begin or end in a (or both).

$$\text{letter} = a | b | \dots | z$$

$$R.E = a(\text{letter})^* | (\text{letter})^*a$$

(c) (5 %) All strings of digits that contain no leading zeros.

$$R.E = (1 | \dots | 9)(0 | 1 | \dots | 9)^*$$

(d) (5 %) All strings of digits that represent even numbers.

$$\text{digit} = 0 | 1 | \dots | 9$$

$$R.E = (\text{digit})^*(0 | 2 | 4 | 6 | 8)$$

(e) (5 %) All strings of digits such that all the 2's occur before all the 9's.

$$R.E = (0 | 1 | 2 | \dots | 8)^*(0 | 1 | 3 | \dots | 9)^*$$

✱ (5 %) All strings of a's and b's that contain no three consecutive b's.

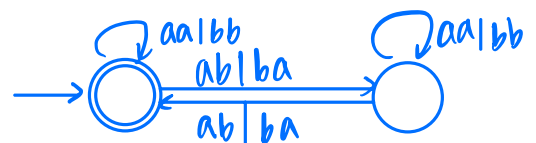
$$R.E = (a | b | bb)(a | ab | abb)^*$$

✱ (5 %) All strings of a's and b's that contain an odd number of a's or an odd number of b's (or both).

$$R.E = \underbrace{(b^*a(b|ab^*a)^*)}_{\text{奇}a} | \underbrace{(a^*b(a|ba^*b)^*)}_{\text{奇}b}$$

✱ (5 %) All strings of a's and b's that contain an even number of a's and an even number of b's.

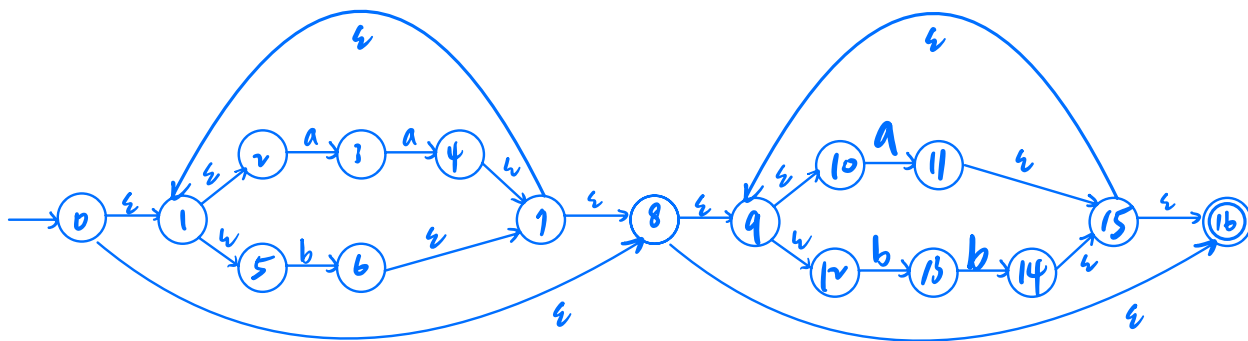
$$R.E = (ab|ba)(aa|bb)^*(ab|ba)(bb|aa)^*$$



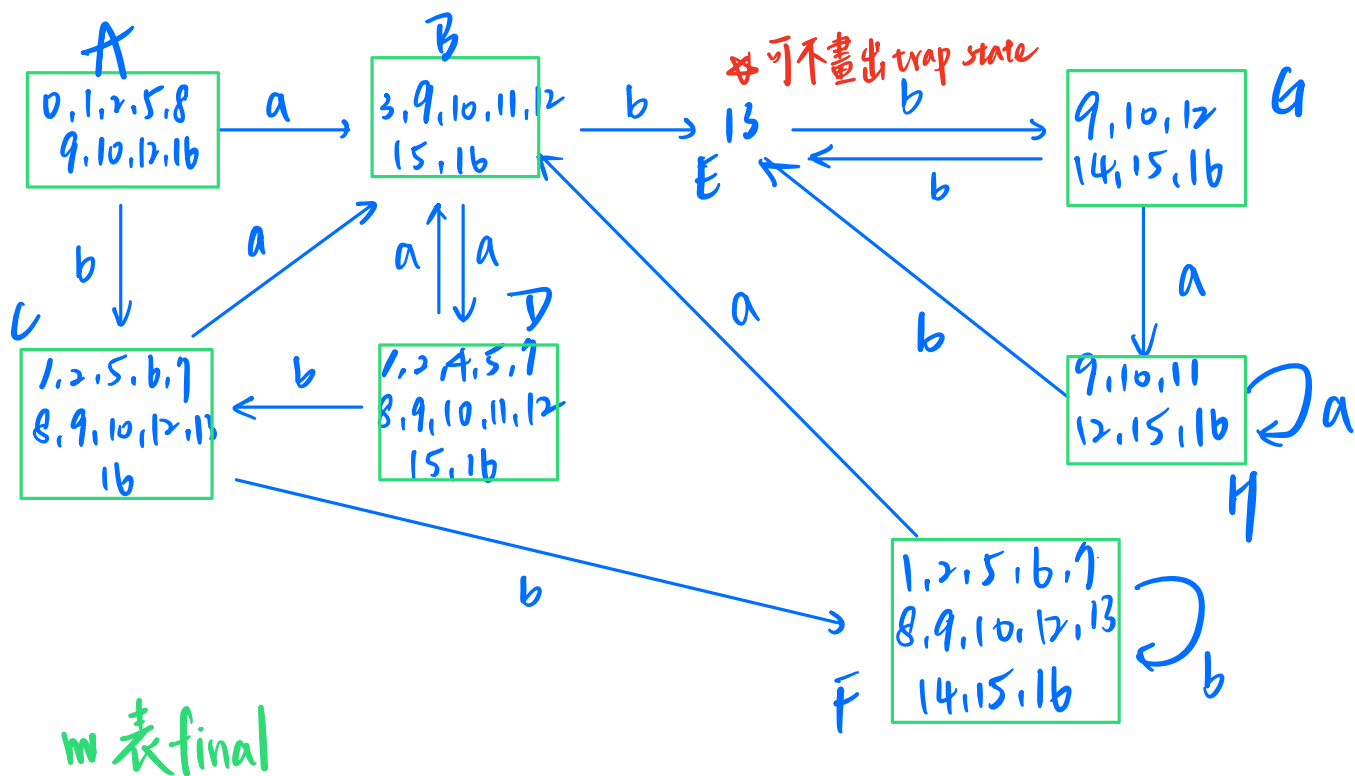
(i) (5 %) All strings of a's and b's that contain exactly as many a's and b's.

No R.E because R.E can't count

2. (25 %) Use Thompson's construction to convert the regular expression $(aa|b)^*(a|bb)^*$ into an NFA.



3. (30 %) Convert the NFA of part 2 into a DFA using the subset construction.



$$A = \epsilon\text{-closure}(s) = [0, 1, 2, 5, 8, 9, 10, 12, 16]$$

$$B = \epsilon\text{-closure}([3, 11]) = [3, 9, 10, 11, 12, 15, 16]$$

⋮

all strings of a's and b's, including the empty string.

$$R.E. = (a|b)^*$$

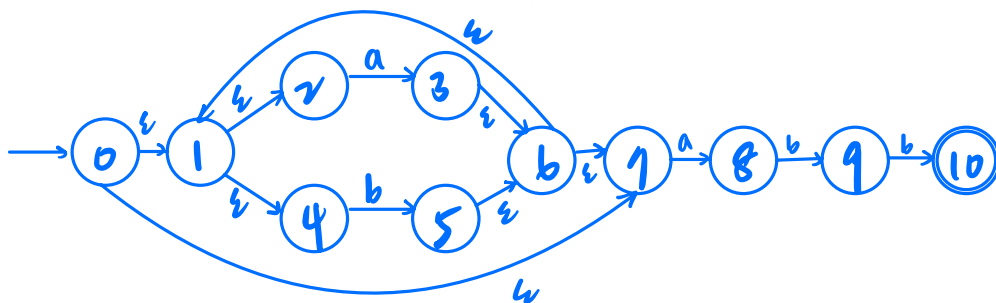
all strings of even length

$$R.E = (aa|ab|ba|bb)^*$$

all strings of length 0 or 1

$$R.E = \epsilon | a | b$$

■ Construct the r.e. $(a|b)^*abb$ based on the above algorithm.



轉 DFA

