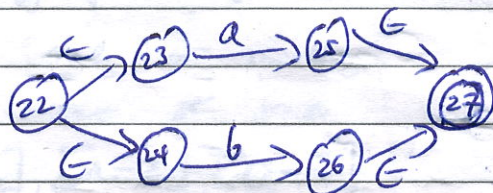
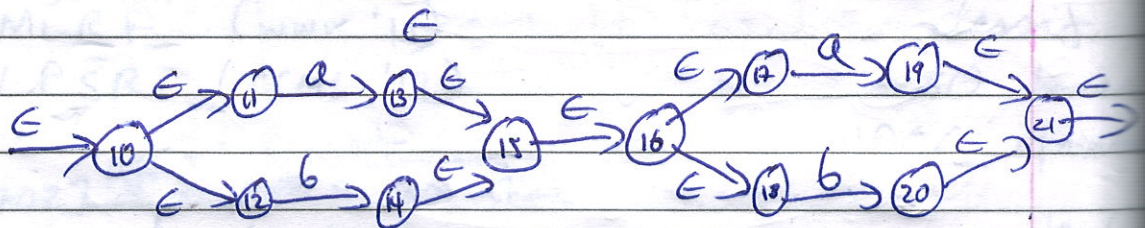
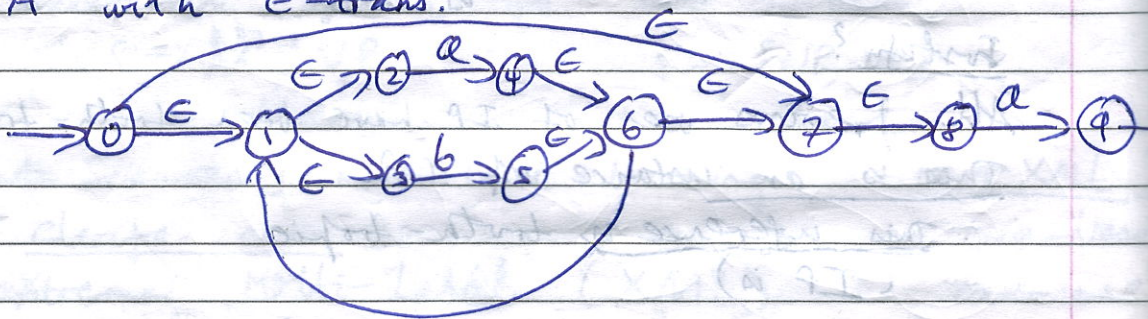


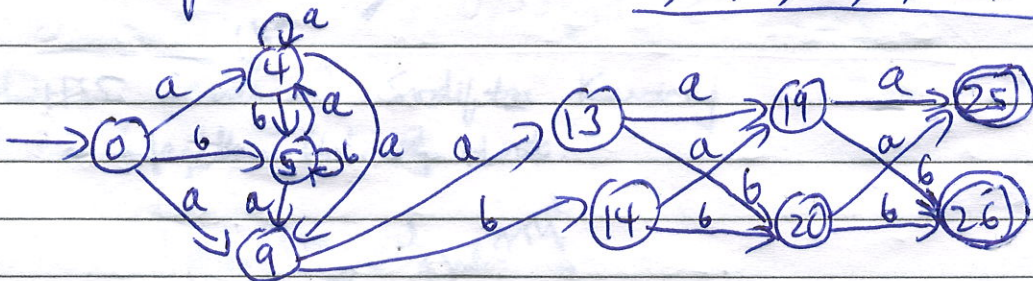
1. a) All binary strings of length  $\geq 2$  starting and ending with 0.
  - b) All binary strings of length  $\geq 3$  where the third bit from the end is 0.
  - c) All binary strings with an even number of 0s and 1s.
2. a)  $a^* b^* c^* \dots z^*$
  - b)  $0^* (11^* | 11^* 0)^*$

3. NFA with  $\epsilon$ -trans.



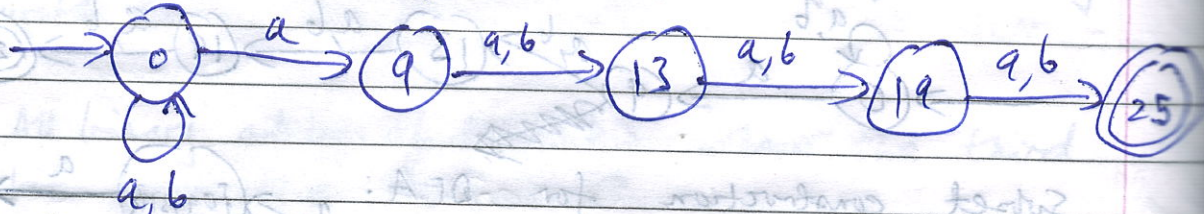
NFA without  $\epsilon$ -trans.

Important states: 0, 4, 5, 9, 13, 14, 19, 20, 25, 26



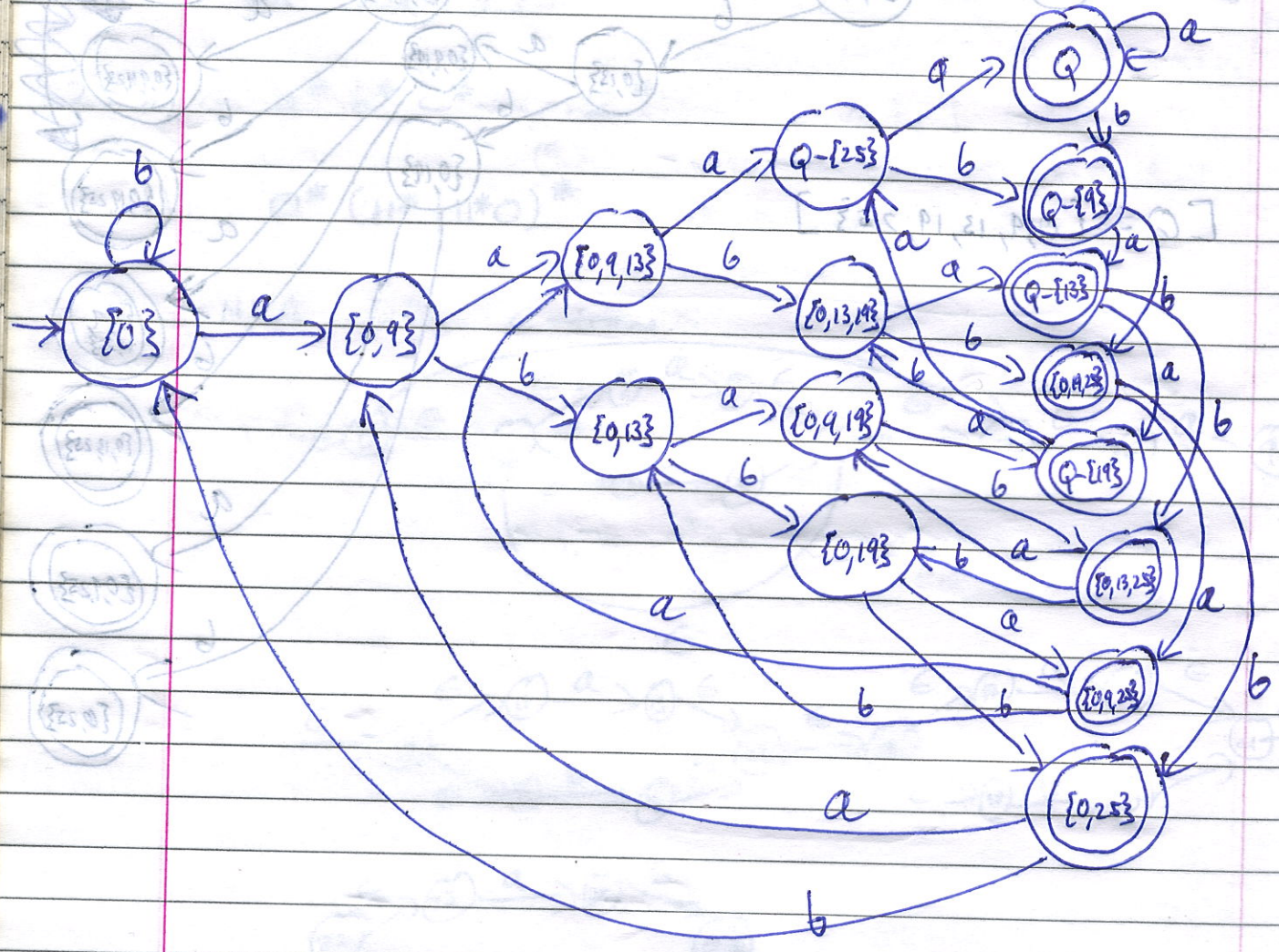


Club together equivalent states:



Subset construction for DFA:

[Let  $Q = \{0, 9, 13, 19, 25\}$ , the full set of states at



This DFA cannot be minimized further. One way to understand why we need 16 states is to realise that we need to retain memory of the last 4 characters of the input. So we have  $2^4 = 16$  possible suffixes, each corresponding to one of the above states. The 8 suffixes starting with 'a' are the 8 accepting states.



