Revision: Week 1   Due: 10 am on 12/08/2024

① Find the error in the following proof that
$$2 = 1.$$

Let a, b be any two integers such that $a = b$.
Then, $a^2 = ab$ (Multiplying by a)
$\Rightarrow a^2 - b^2 = ab - b^2$ (Subtracting by b^2)
$\Rightarrow (a+b)(a-b) = (a-b)b$ (Factoring)
$\Rightarrow a + b = b$ (Dividing by $(a-b)$)

Substituting $a = b = 1$, we get the required
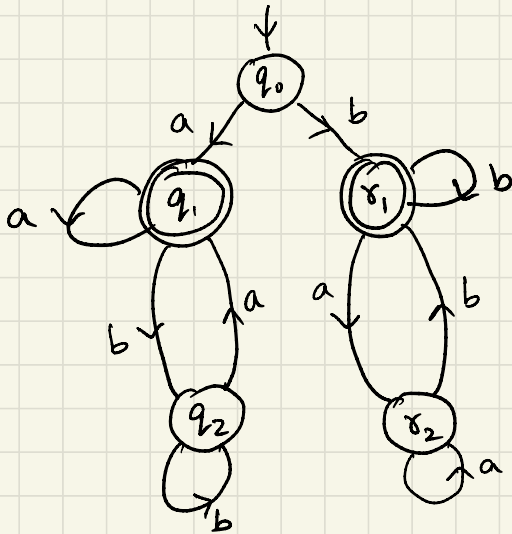   Statement.   [2]

② What is the cardinality of the following sets?
  i) Set of strings over $\Sigma = \{0,1\}$ that have length n.
  ii) Set of strings over $\Sigma = \{0,1\}$.
  iii) Set of Languages over $\Sigma = \{0,1\}$. [1+2+2]

(3) What is the formal description of the following machine? What is the language accepted by it? Prove it's correctness.
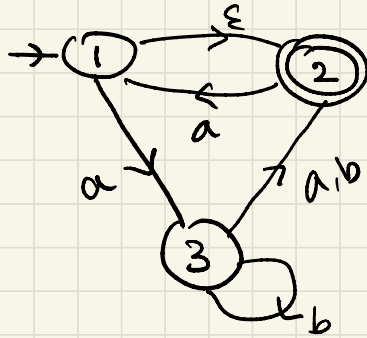

$$[3+3]$$

(4) Give state diagrams of DFA's recognising the following languages over $\{0,1\}$. Prove it's correctness.

i) All strings except the empty string.

ii) The empty set.

iii) All strings that start with zero and has odd length or starts with one and has even length. $\quad [2+2+4]$

(5) Use the construction done in class

to draw an equivalent DFA for the
following NFA. Proof of correctness
is not required.

[4]