

# CM1025

## Fundamentals of Computer Science

1. Negate the following formulae.

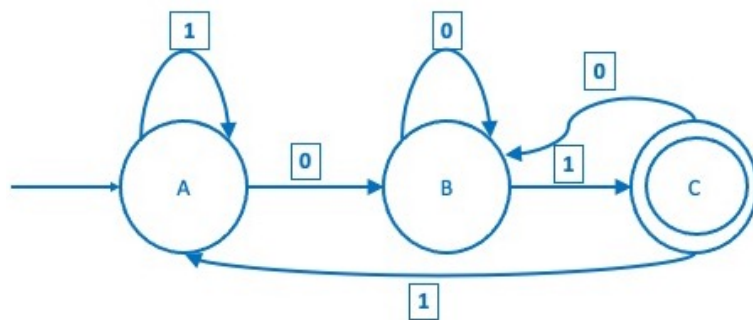
- a)  $p \vee q \wedge \neg r$
- b)  $(p \rightarrow \neg q) \wedge \neg p$

2. Prove the following statement by induction.

For all  $n > 0$ ,  $5^n - 1$  is divisible by 4.

3. Students are required to create 5-character long passwords to access the library. The letters must be from lowercase letters or digits. Each password must **start with** a lowercase-letter and **end with** a digit and contain **at most 2** digits. How many valid passwords are there?

4. Consider the following automaton.



- a) Give an example of a string that is **accepted** by this automaton.
  - b) Give an example of a string that is **rejected** by this automaton.
  - c) Describe the language of this automaton.
- 5.
- a) Give an example of a string **in** the language of  $(0^*10^+)^+$ .
  - b) Give an example of a string that is **not in** the language of  $(0^*10^+)^+$ .
  - c) Design a regular expression that accepts the language of all binary strings with **exactly one** occurrence of aa.