CA313 Algorithms and Complexity
Class Test 1

Attempt **all** questions. All questions carry equal marks. You have **40 mins.** to attempt these questions.

Name:

Student Number:

Q 1.
Given two sets $A = \{a, b, c\}$ and $B = \{c, d, e\}$, give:

- $A \cup B =$
- $A \cap B =$
- $A - B =$
- $B - A =$
- $A \Delta B =$
- the *Power Set* of A, $\wp(A) =$

Q 2.
(i) Given sets $A = \{\alpha, \beta, \gamma, \delta\}$ and $B = \{W, X, Y, Z\}$, give an example:

- surjective but non-injective relation between A and B;

- injective but non-surjective relation between A and B;

- surjective and injective relation between A and B.

(ii) By what term is a surjective and injective relation between two sets known as?

Q 3.
Prove by induction that $n^3 + 2n$ is divisible by 3 for all $n \geq 0$.

Q 4.
(i) Provide, and explain, the quadruple $\langle V_t, V_n, P, S \rangle$ by which a grammar for any language is defined.

(ii) Give grammars (*formally*, i.e. in terms of the 4-tuple $\langle V_t, V_n, P, S \rangle$, which can recognise the following languages.

- x^n

- $\mathrm{x}^n\mathrm{y}^n$