COMP 272 Theory of Computation

October 2, 1996 **Quiz One**

Name: _____ E-mail: _____

Student No: _____ Lecture: _____

Tutorial: _____

- Answer **ALL** questions. You are only required to write down the answers; you do not need to justify them. In questions 4 and 5 you only need to draw the state diagram of the DFA; you do not need to prove it is correct. Do not forget to denote the start and final states properly.
- Time allowed: 45 minutes.
- The exam is worth 150 points. Each question is worth 30..

1. Let $N = \{0, 1, 2, 3, \ldots\}$ be the set of whole numbers. $N^i = \overbrace{N \times N \times \cdots \times N}^{i \text{ times}}$. For each of the following sets decide whether they are countable or not countable and circle the correct answer:

(**a**)	$N \times N \times N$	countable	uncountable
(**b**)	2^N	countable	uncountable
(**c**)	$\cup_{i=0}^{\infty} N^i$	countable	uncountable

2. Write a regular expression representing the following language. *Note:* 0 is divisible by both 2 and 3:

$$\{w \in \{a,b\}^* : \quad \text{(Number of } a\text{-s in } w \text{ is divisible by 2)}$$
$$\text{or (number of } b\text{-s in } w \text{ is divisible by 3), or both}\}$$

3. Write a regular expression representing the following language:

$$\{w \in \{a,b\}^* : w \text{ does not contain } aaa\}.$$

4. Draw a DFA that accepts the language

$$\{w \in \{a,b\}^* : \quad \text{(Number of } a\text{-s in } w \text{ is odd and number of } b\text{-s is even)}$$
$$\text{or} \quad \text{(Number of } a\text{-s in } w \text{ is even and number of } b\text{-s is odd)}\}$$

5. Draw a DFA that accepts the language

$$\{w \in \{0,1\}^* : \ w \text{ contains the string } 01101\}.$$