Application Assignment 2

CIS*2910 Discrete Structures in Computing II

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CIS*2910 Assignment 2

Prove or disprove 3 marks

Assume k is the number of neurons and each neuron can connect to at most k-1 neurons

Because all neurons can only connect to at most k-1 neurons and not k neurons, there should be at least two neurons connected to the same number of other neurons assuming that all neurons has to connect at least one neuron

For example, if we are given four neurons and the first three neurons connects to different number of neurons (1 neuron, 2 neurons, 3 neurons), there is no choice for the last neuron but to have the same number of neuron connection with one of them (1, 2 or 3). Pigeonhole principle

Therefore, in a neural network with at least two neurons, there exist two neurons connected to the same number of other neurons

2nd question [3 marks]

Let 4 universities be A, B, C, D

No tie $4! = 24 = 1$

All tie $A = B = C = D = 1$

Three tie $A > BCD$, $B > ACD$, $C > ABD$, $D > ABC = 4 \times 2$ (vice versa) $= 8$

two tie $\binom{4}{2} = 6$

5 marks

(a) $N=9$

$2^9 - \binom{9}{3} - \binom{9}{2} - \binom{9}{1} - \binom{9}{0}$

$512 - 84 - 36 - 9 - 1 = 382$

$N=10$

$2^{10} - \binom{10}{3} - \binom{10}{2} - \binom{10}{1} - \binom{10}{0}$

$1024 - 120 - 45 - 10 - 1 = 848$

b) $N=9$ $N=10$

$\binom{7}{2} = 21$ $\binom{8}{2} = 28$

c) $N=9$ $N=10$

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