

## 2001 Paper 7 Question 7

### Neural Computing

- (a) (i) In a Hopfield neural network configured as an associative memory, with all of its weights trained and fixed, what *three* possible behaviours may occur over time in configuration space as the net continues to iterate in response to a given input? [3 marks]
- (ii) How many stable content-addressable memories would you expect a fully connected Hopfield network consisting of 100 neurons to be capable of storing? [1 mark]
- (iii) What property of those memory patterns would make it most probable that you could successfully train the network to store the maximum number, and why? [3 marks]
- (b) Explain how five independent dimensions of visual processing are multiplexed together into the three available spatial dimensions of neural tissue, by the structure of the cubic millimetre hypercolumns in the brain's visual cortex. [5 marks]
- (c) The retina is often regarded as an image capture device; but it has about 100 million input sensors (photoreceptors) yet only 1 million output fibres (optic nerve axons). What are some implications of this 100-to-1 ratio of input channels to output channels? [4 marks]
- (d) Provide some quantitative evidence and arguments supporting the proposition that: "Connectivity is the basic computational principle in the brain". [4 marks]