

## 2002 Paper 2 Question 10

### Structured Hardware Design

You have been engaged as a consultant by a company which proposes to manufacture an electronic game which makes use of a grid of 10 000 pin sites, where a pin can be inserted to close a contact pair. There is an LED next to each pin site to indicate the current deployment of the player's opponent.

There is a loudspeaker for replaying spoken messages which are to be pre-recorded and built in at manufacture. There are four push buttons for controlling the game.

Sales volumes will be such that custom chips could be used throughout the product, but the chips are constrained by the low-cost assembly technology to have no more than 100 pins each.

- (a) All the components are to be mounted on one printed-circuit board (PCB). Decide how many chips to use in the product and explain how the PCB wiring makes efficient connection to the 10 000 contact pairs and LEDs. [5 marks]
- (b) The rules of the game must be built into the device. Comment on the factors which influence how these rules might be represented. [4 marks]
- (c) By sketching a block diagram or otherwise, describe the remaining details of the design, including the role of memory and how audio is generated. [6 marks]
- (d) The product should be capable of being upgraded to have networking capability via a plug-in infra red or Bluetooth module. This will enable multiple devices in the same room to communicate with each other so that multi-player games may be played. What must be added to the base product to support this option? [5 marks]