COMPUTER SCIENCE TRIPOS Part II – 2015 – Paper 9

10   System-on-Chip Design (DJG)

(*a*) The key for a modern motor car contains a computer, a battery and a radio transmitter. The key has three push buttons. It sends a binary sequence for each key press.

   (*i*)   Sketch a basic block diagram of a feasible implementation. Show all the major components and indicate how many pieces of silicon might be used. Briefly discuss whether a standard part or a custom SoC should be used in this application. [4 marks]

   (*ii*) Explain the likely internal processing steps for the key when a button is pressed with emphasis on how the computer does its I/O. [4 marks]

   (*iii*) How would you predict the likely battery life of the key before prototype manufacture? [4 marks]

(*b*) (*i*)   Give a pair of synchronous circuits for an RTL module that have identical observable external behaviour but that differ in energy use. Either use RTL or a draw a diagram. Each should have at least one flip-flop and just a few combinational gates and no redundant logic. [3 marks]

   (*ii*) State with justification what form of equivalence checker would be needed to determine that your circuits are equivalent. [2 marks]

   (*iii*) Say why your pair of circuits use different amounts of energy. Give answers for both static and dynamic power. [3 marks]