Digital Electronics

An $m : 1$ multiplexer has $m$ data inputs, $\log_2 m$ control signals and produces a data output which is equal to the input selected by the control signals. Each different combination of control signals selects a different input. Present an implementation, either as a circuit diagram or as equations, of an $8 : 1$ multiplexer. [5 marks]

Show how $8 : 1$ multiplexers can be cascaded to build a $64 : 1$ multiplexer. [5 marks]

A $2^m$-bit decoder has $m$ inputs and $2^m$ outputs, with only one output taking the value 1 at a time. The particular output which has the value 1 at any given time is determined by the inputs. Each different combination of inputs selects a different output. Present an implementation of an $8$-bit decoder. [5 marks]

How might a decoder be used as a functional component of a read-only memory? [5 marks]