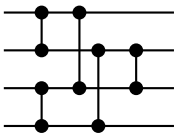
COMPUTER SCIENCE TRIPOS Part II – 2016 – Paper 7

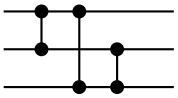
1 Advanced Algorithms (TMS)

(*a*) State the zero-one principle in the context of sorting networks. [2 marks]

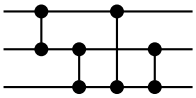
(*b*) For each of the following six comparison networks, state whether it is a sorting network or not. In each case, justify your answer. For the justification you may refer to standard results without giving a proof. [9 marks]



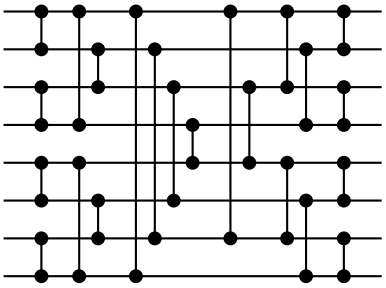
(1)



(2)



(3)



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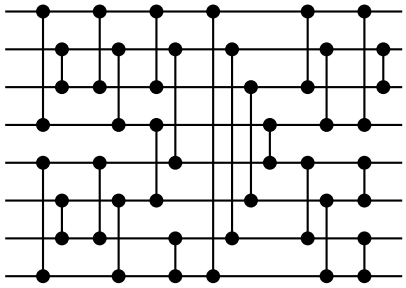
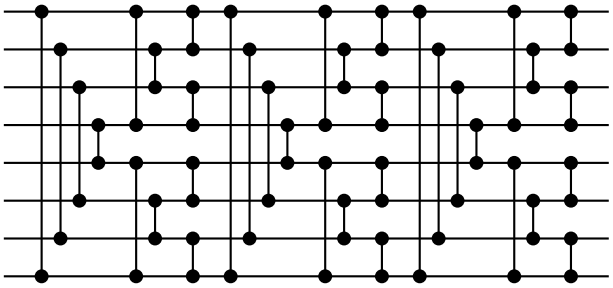


(5)



(6)

(*c*) Let n be an exact power of 2. Show how to construct an n-input, n-output comparison network of depth $\log n$ in which the top output wire always carries the minimum input value and the bottom output wire always carries the maximum input value. [4 marks]

(*d*) (*i*) Prove that the number of comparators in any sorting network is $\Omega(n \log n)$. [4 marks]

(*ii*) What does Part (*d*)(*i*) imply in terms of the depth of any sorting network? [1 mark]