

**Full Name:**

**Andrew Id:**

15-418/618  
Exercise 4  
Answer Sheet

**Problem 1: Lock Implementations**

A. Direct.

B. Test.

C. Backoff.



### **Problem 3: Interconnection Networks**

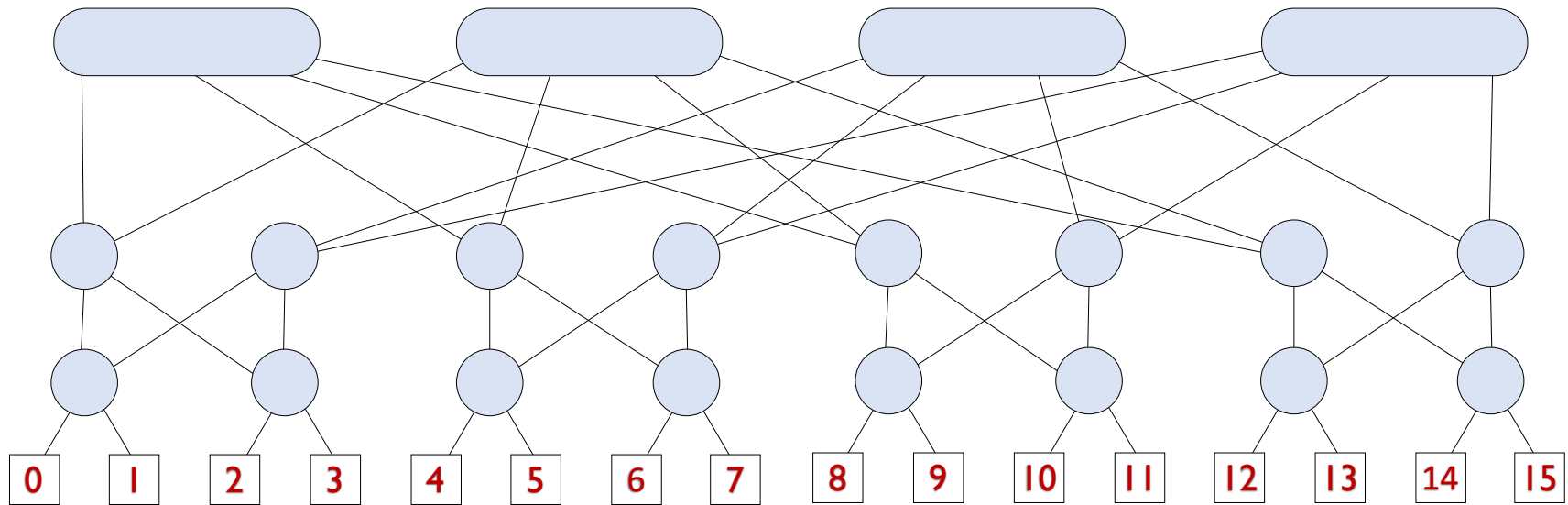


Figure 1: Fat-tree network, showing the recursive structure

- A. Identify the  $k/2$  subnetworks of type  $N(k, 2)$  for  $k = 4$  in Figure 1. You can do this by modifying the diagram in Figure 1. Use different colors for the switches to indicate the different subnetworks and the additional switches.
- B. Derive a closed-form formula for  $P(k, l)$ .
- C. Show that you could set up the eight links forming a *mirror permutation*, mapping port  $i$  to port  $N - i - 1$  for  $0 \leq i < N/2$ . You can do this by modifying the diagram in Figure 2. Use different colors to illustrate the different links.

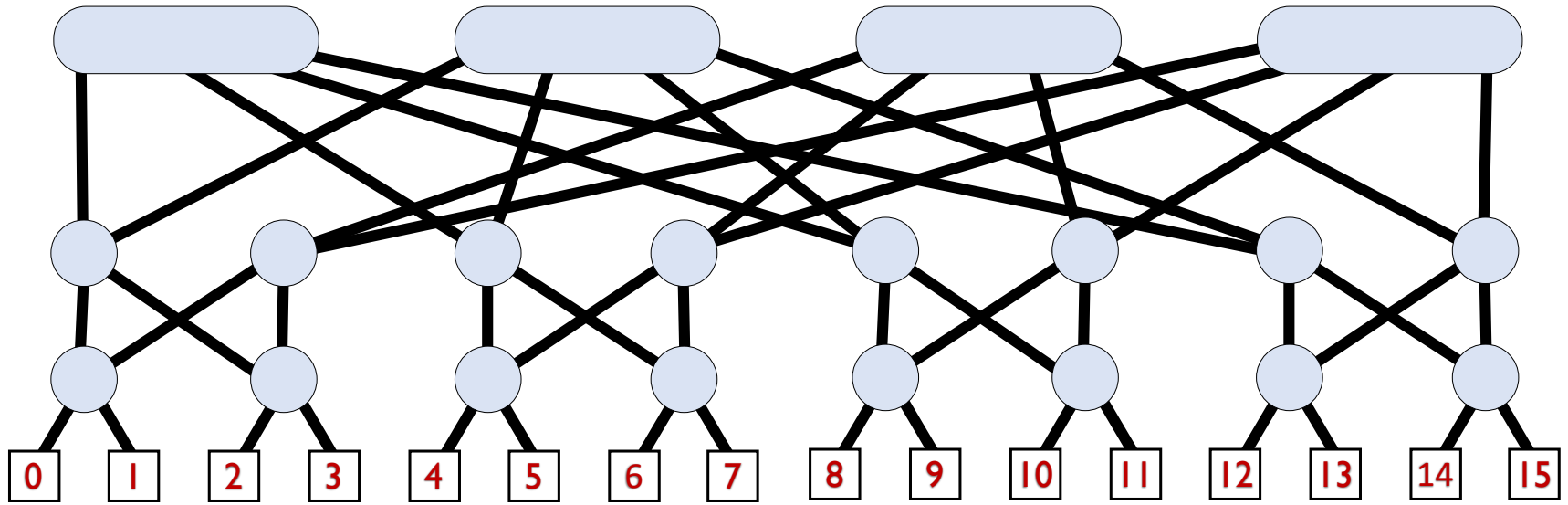


Figure 2: Fat-tree network with links for mirror permutation