

## Part I

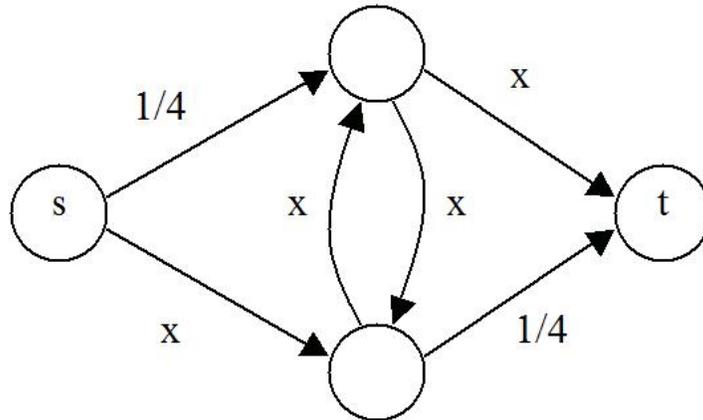


Figure 1: A selfish routing instance.

In Figure 1, one unit of traffic ( $r = 1$ ) is to be routed from  $s$  to  $t$ . What is the price of anarchy?

## Part II

Let  $(G, r, c)$  be a nonatomic selfish routing game such that

1. The cost functions in  $c$  are M/M/1 delay functions. That is, they come from the set  $\{f_u(x) | u > 0\}$ , where

$$f_u(x) = \begin{cases} 1/(u-x) & \text{if } 0 \leq x < u \\ \infty & \text{otherwise} \end{cases} .$$

The value  $u$  is called the *capacity* of the edge.

2. It is possible to route all commodities without reaching any edge capacities.

Show that the price of anarchy for such a game can be arbitrarily high.