

# CS345 Theoretical Assignment 4

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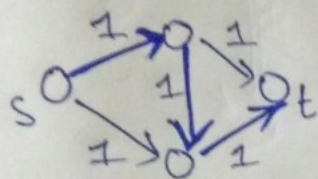
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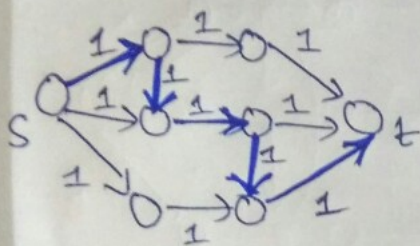
# 1 Any Guarantee of our First-Attempt Algorithm

## 1.1 Counter Example

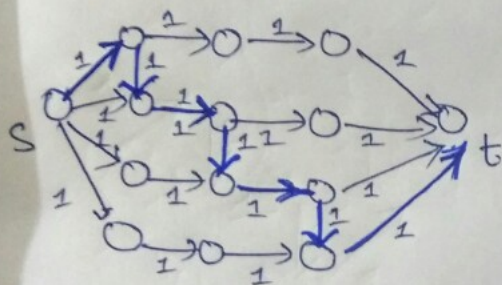
Counter Example



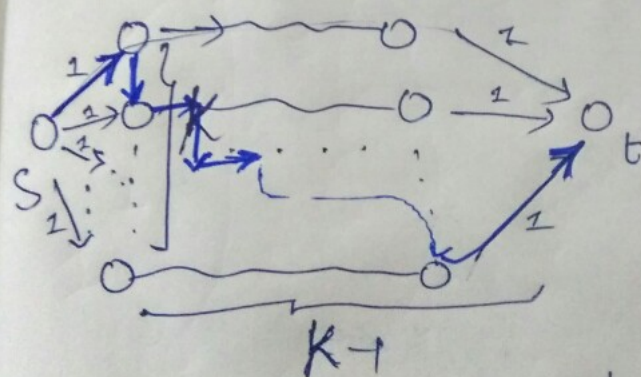
for the shown path chosen  
first  $\rightarrow \frac{\text{flow returned}}{\text{Actual max flow}} = \frac{1}{2}$



" =  $\frac{1}{3}$



" =  $\frac{1}{4}$



" =  $\frac{1}{k}$

That is, we have to construct one path such that it blocks all other  $k-1$  paths possible. This construction possible  $\forall k > 1$   
 $\Rightarrow$  Approximation Not possible

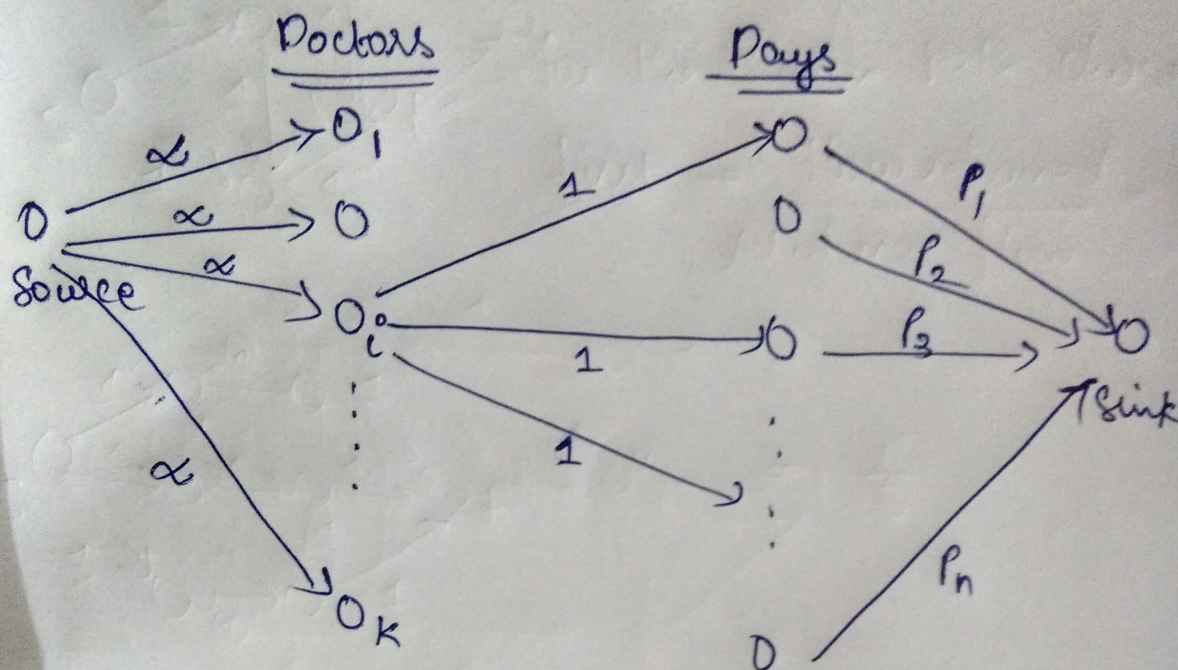


## 2 A max flow application

### 2.1 Without Extra Constraint

#### 2.1.1 Overview

### A max flow Application



Doctors  $[i]$  to Days  $[j]$  there is an edge  
iff  $j$  lies in the list  $L_i$ .

All these edges inserted between Doctors  
& Days hold capacity 1.

$L'_1, \dots, L'_K$  exists if Max flow of  
above graph is  $\sum_{i=1}^n p_i$ .

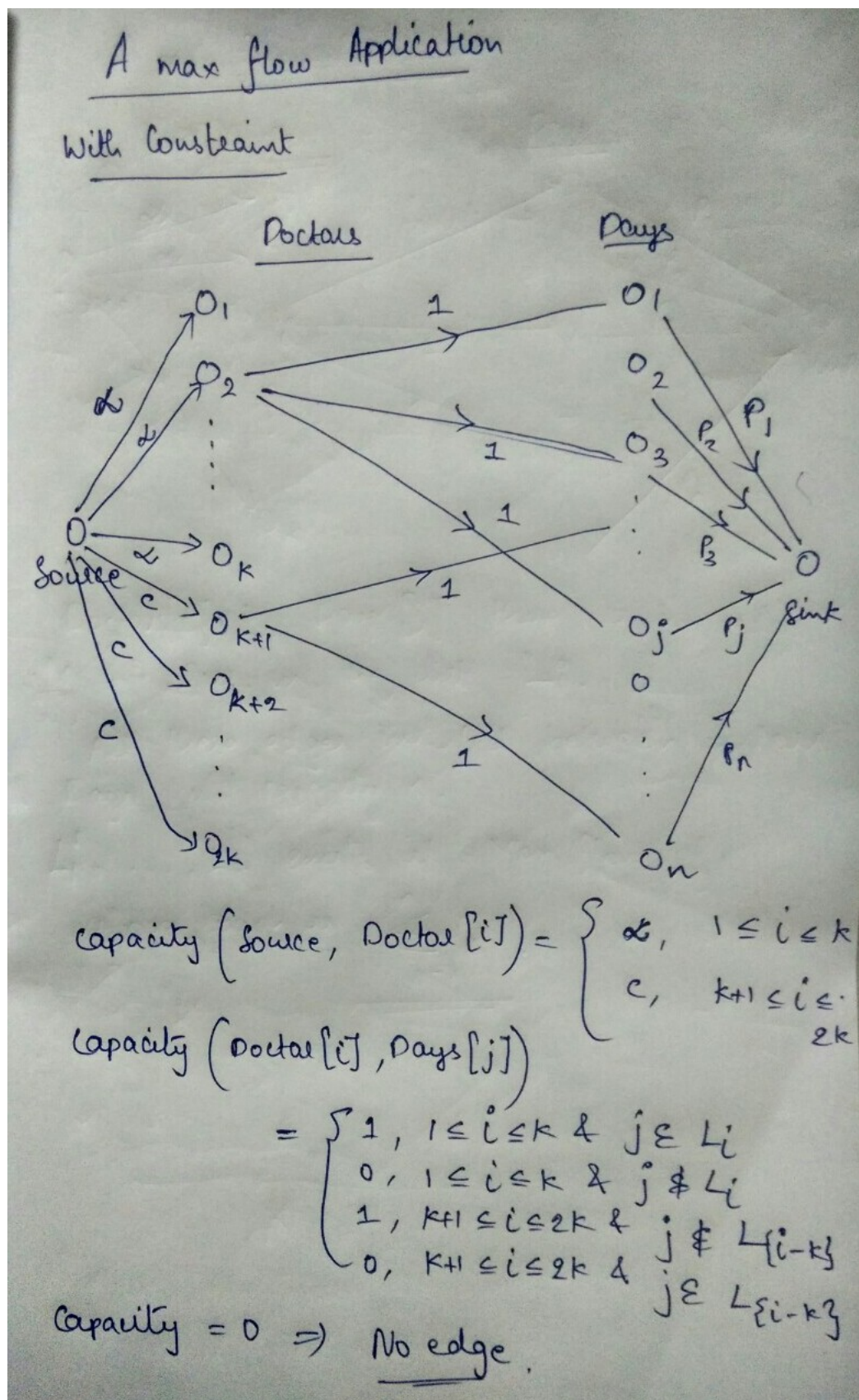
### **2.1.2 Claim**

### **2.1.3 Proof**



## 2.2 With Extra Constraint

### 2.2.1 Overview



### 2.2.2 Claim

### 2.2.3 Proof