

**CSC 226 Assignment 5 Written**

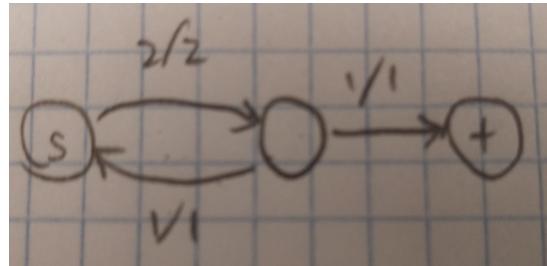
1. Create recursively calls itself and knocks down walls in the order of a random permutation. It's essentially a DFS over the maze. Since it only removes one wall at a time and only removes walls on cells where a wall has not yet been removed, it is guaranteed not to create mazes with cycles. Thus it will always create a maze with a unique solution. The knockDown method removes more walls to create more possible solutions.

If there are  $n$  rows and  $m$  columns, then Create is called  $n \cdot m$  times since it knocks down walls in each cell of the  $n$  by  $m$  maze.

The purpose of  $p^2$  is to perform  $p \text{ XOR } 2$ . This will flip any bits set to 1 except the bit in the 2 place. It is used in Create() in the process of knocking down walls.

2. The estimated amount of vertices is  $8 + 8 \cdot 6 + 8 \cdot 6 \cdot 4 + 8 \cdot 6 \cdot 4 \cdot 3 + 8 \cdot 6 \cdot 4 \cdot 3 \cdot 2 = 1976$ . The actual amount is 1836. This is pretty accurate.

a) False



b) True. Proof:

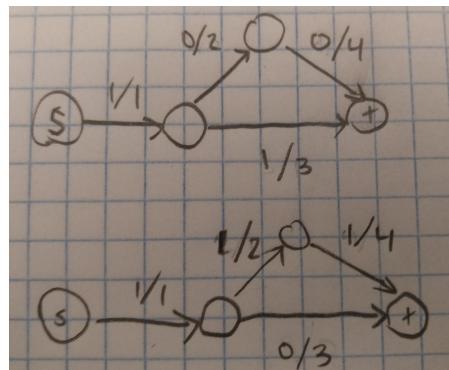
Let  $f$  be a max flow.

Let  $c$  be a positive flow cycle.

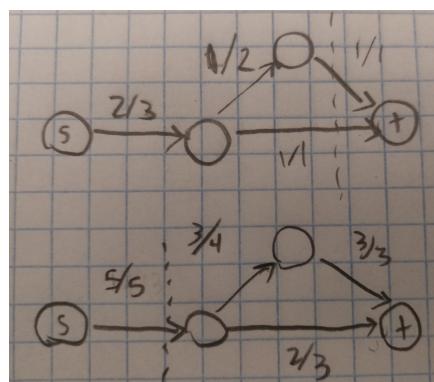
Let  $d = \min(e \in c) f(e)$ .

If you reduce the flow of each edge in  $c$  by  $d$ , the value of the flow is maintained and the flow  $f(e)$  of at least one of the edges  $e \in c$  is set to zero.

c) False



d) False, constant = 2



e) True.

Every cut gets multiplied by a constant. The relative order of cuts doesn't change.

The maxflow and mincut are 25.

