

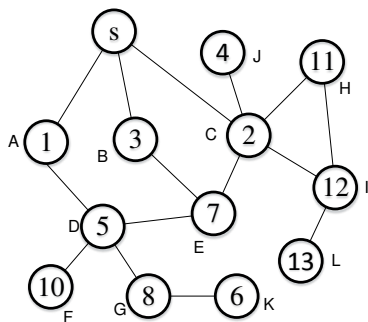
# Mechanism Design in Social Networks

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# Promote a Sale in Social Networks



- The revenue of applying VCG (second price without promotion) is **2**.
- The highest willing payment is **13**.

# Traditional Sale Promotions

- Promotions in **shopping centres**
- Keywords based ads via **search engines** such as Google
- Ads via **social media** such as Facebook, Twitter

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## Challenge

- The return of these promotions are unpredictable.
- The seller may lose from the promotions.

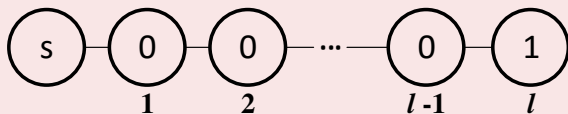
# To Tackle the Challenge

- Build promotion inside the market mechanism such that
  - ① the promotion will **never bring negative utility/revenue** to the seller.
  - ② all **buyers** who are aware of the sale **are incentivized to diffuse the sale information** to all her neighbours.

## Will (extended) VCG solve the challenge?

- *The allocation*: allocate the item to **the highest bidder**
- *The payment*: every bidder pays **the social welfare loss of the others** caused by the bidder's participation

Problem: negative revenue to the seller

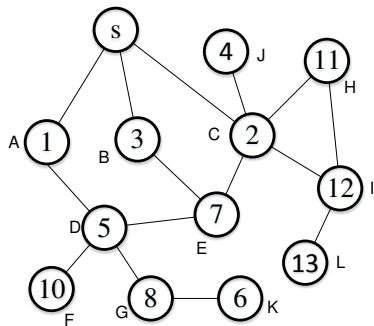


The revenue of the seller is  $-(l - 1)$ .

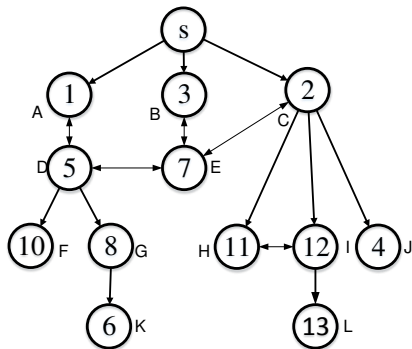
# Our Solution

- Information Diffusion Mechanism

# The Information Diffusion Network



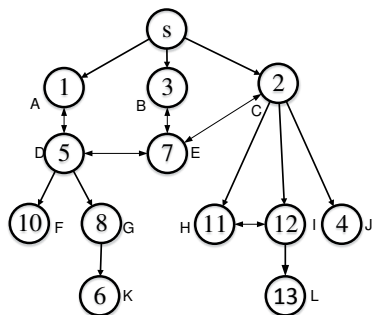
(a) social network



(b) diffusion network



# Diffusion Critical Nodes

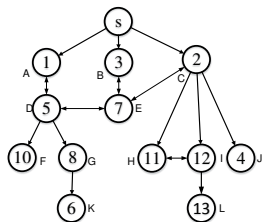


## Definition

$i$  is  $j$ 's **diffusion critical node** if all the information diffusion paths started from the seller  $s$  to  $j$  have to pass  $i$ .

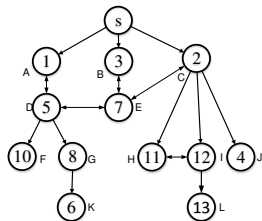
- Nodes C and I are L's only diffusion critical nodes.

# The Information Diffusion Mechanism



- 1 The item is allocated to either the highest bidder or one of its diffusion critical nodes, i.e. {C, I, L}.
- 2 Each of the winner and her diffusion critical nodes pays the highest bid without her participation to her closest diffusion critical node or the seller.
- 3 Start from the diffusion critical node close to the seller (C), the item is allocated to the first node whose valuation is equal to the payment she would receive if the item is passed to the next diffusion critical node.

# Properties of the Information Diffusion Mechanism



- **Truthful**: report true valuation and diffuse the sale information to all her neighbours is a dominate strategy.
- **Individually Rational**: no buyer will receive a negative utility to join the mechanism.
- **Weakly Budget Balanced**: the seller's revenue is non-negative and is  $\geq$  that of the VCG with/without diffusion.

# Future Work

- Diffusion mechanisms for combinatorial exchanges
- Diffusion with costs and delays
- Network structure based revenue analysis
- Applications/implementations in the existing social networks
- Other mechanisms to further improve the revenue and the efficiency