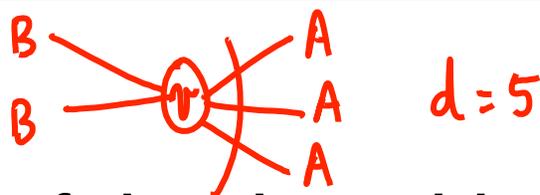


Diffusion thru a Network

- Given a network
- If neighbors adopt same behavior, coordination payoff, else zero

	A	B
A	a,a	0,0
B	0,0	b,b

Which strategy to adopt?



- If p fraction of the d neighbors adopt A, and $(1-p)$ adopt B

– Payoff from A = $pd \cdot a$

– Payoff from B = $(1-p)d \cdot b$

– Adopt A whenever

ties favor A $\leftarrow pd \cdot a \geq (1-p)d \cdot b$

$$pa + pb \geq b$$

$$p \geq \frac{b}{b+pa}$$

1) $b = a$

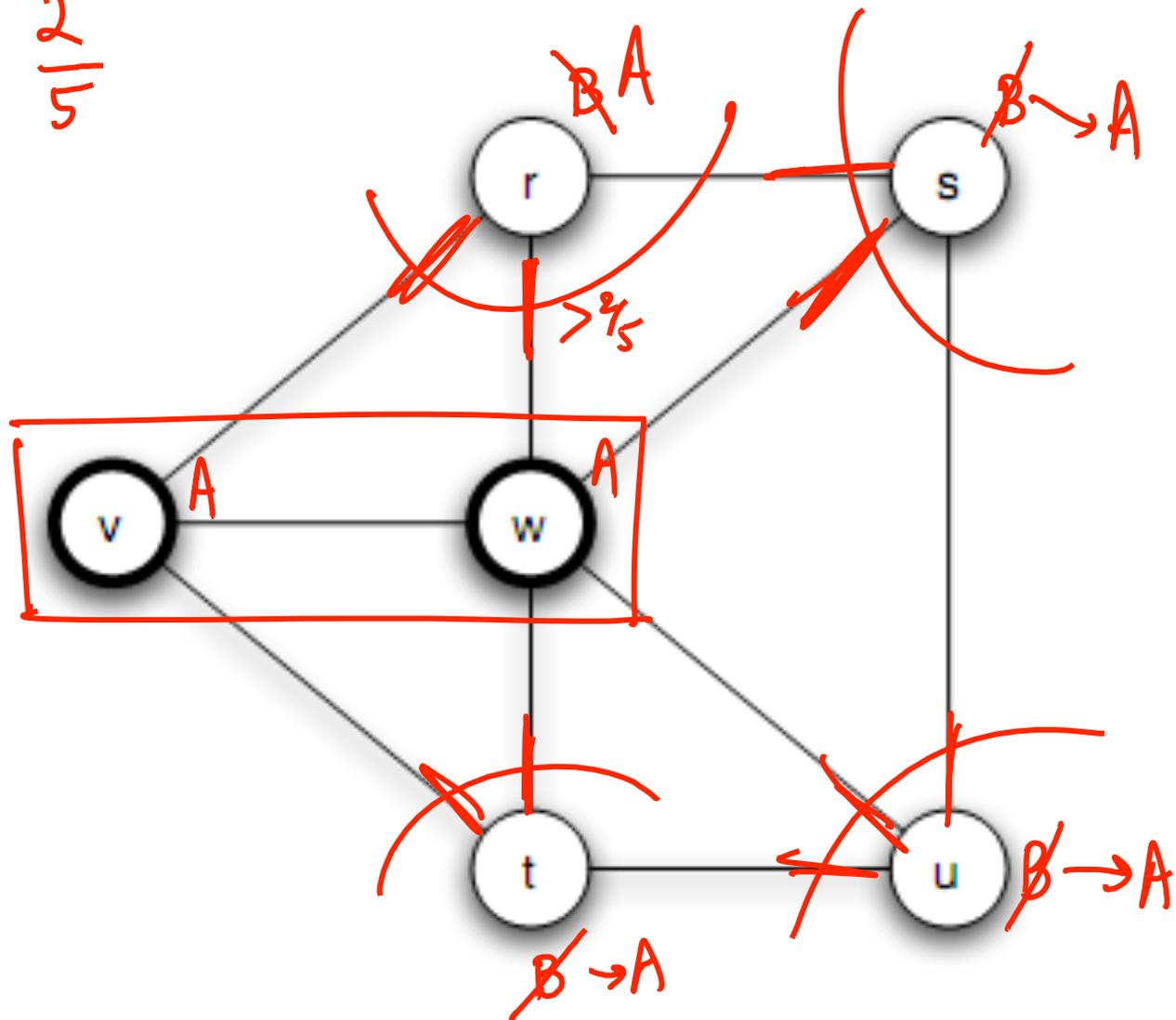
$$p = \frac{1}{2}$$

2) $a = 3b$

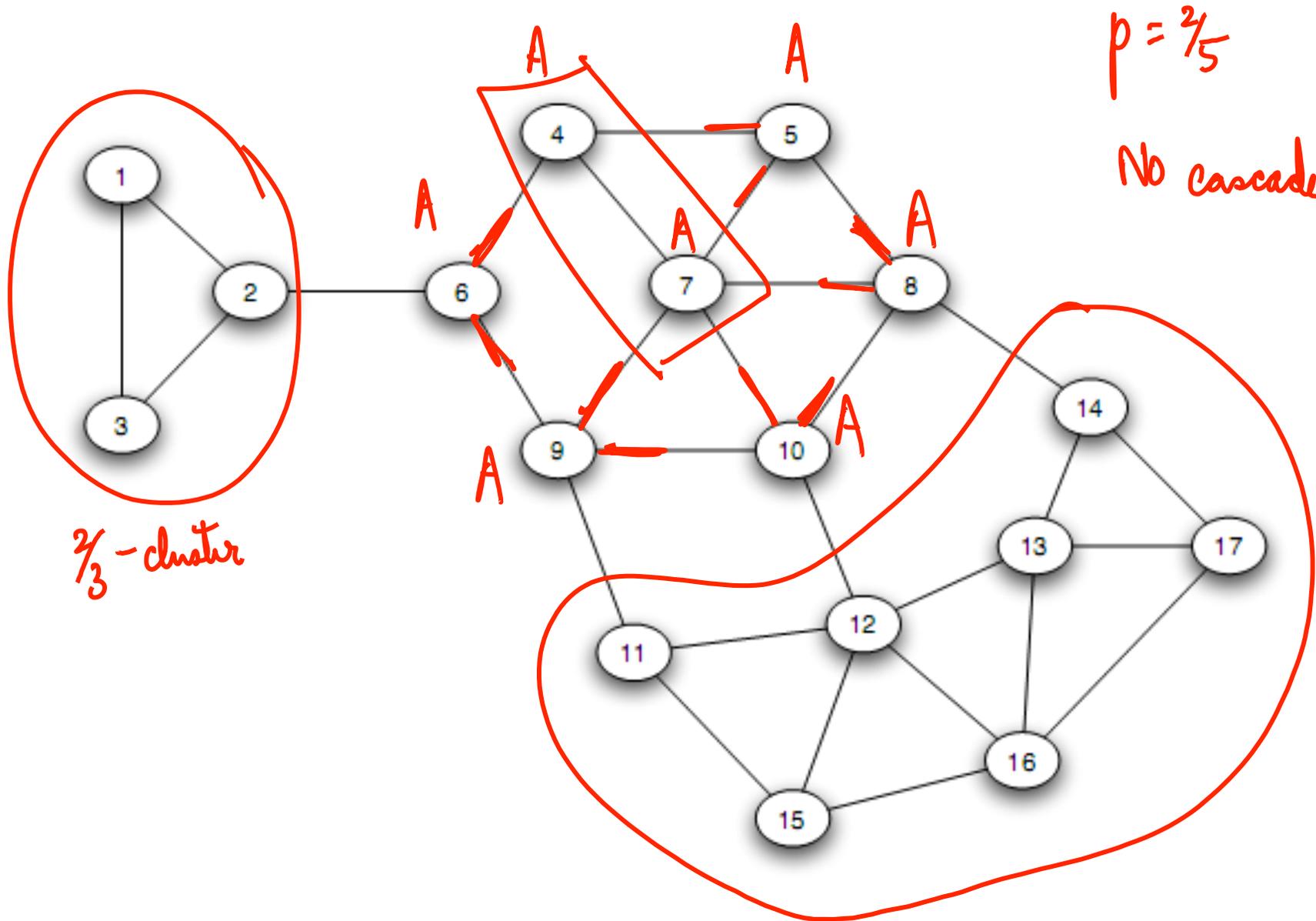
$$p = \frac{b}{b+3b} = \frac{1}{4}$$

Example: $a=3$, $b=2$

$$p = \frac{b}{a+b} = \frac{2}{5}$$



Another example: adopters 4 & 7



- After all nodes interested in switching have done so, suppose there is no full cascade (not all nodes have adopted)
- Does the order of updating the nodes have any implication on the final set that adopted?

- More than one behavior can coexist within different densely connected groups
- To cause a complete cascade, it pays to increase payoff from adopting new behavior
- Choosing key nodes to adopt new behavior can help cascades (e.g. I1 or I4 in previous example)
- Contrast with network effects

What blocks cascades?

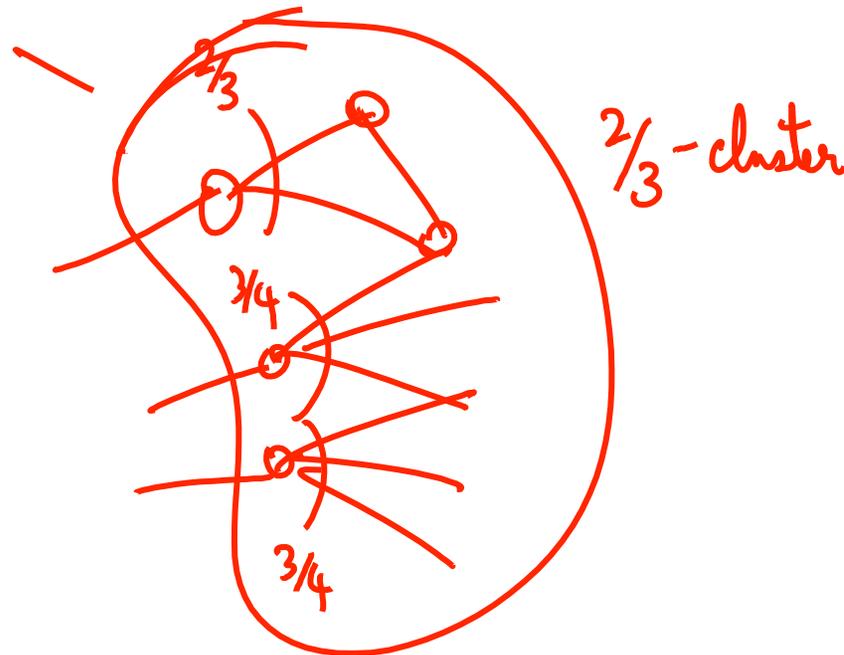
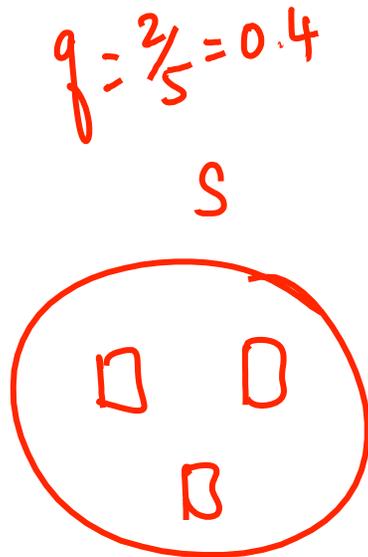
- Clusters of densely connected nodes

Definition: A cluster of density p is a set of nodes such that each node has at least a p -fraction of its neighbors in the set.

(A “clique” of all nodes connected to each other = cluster of density 1)

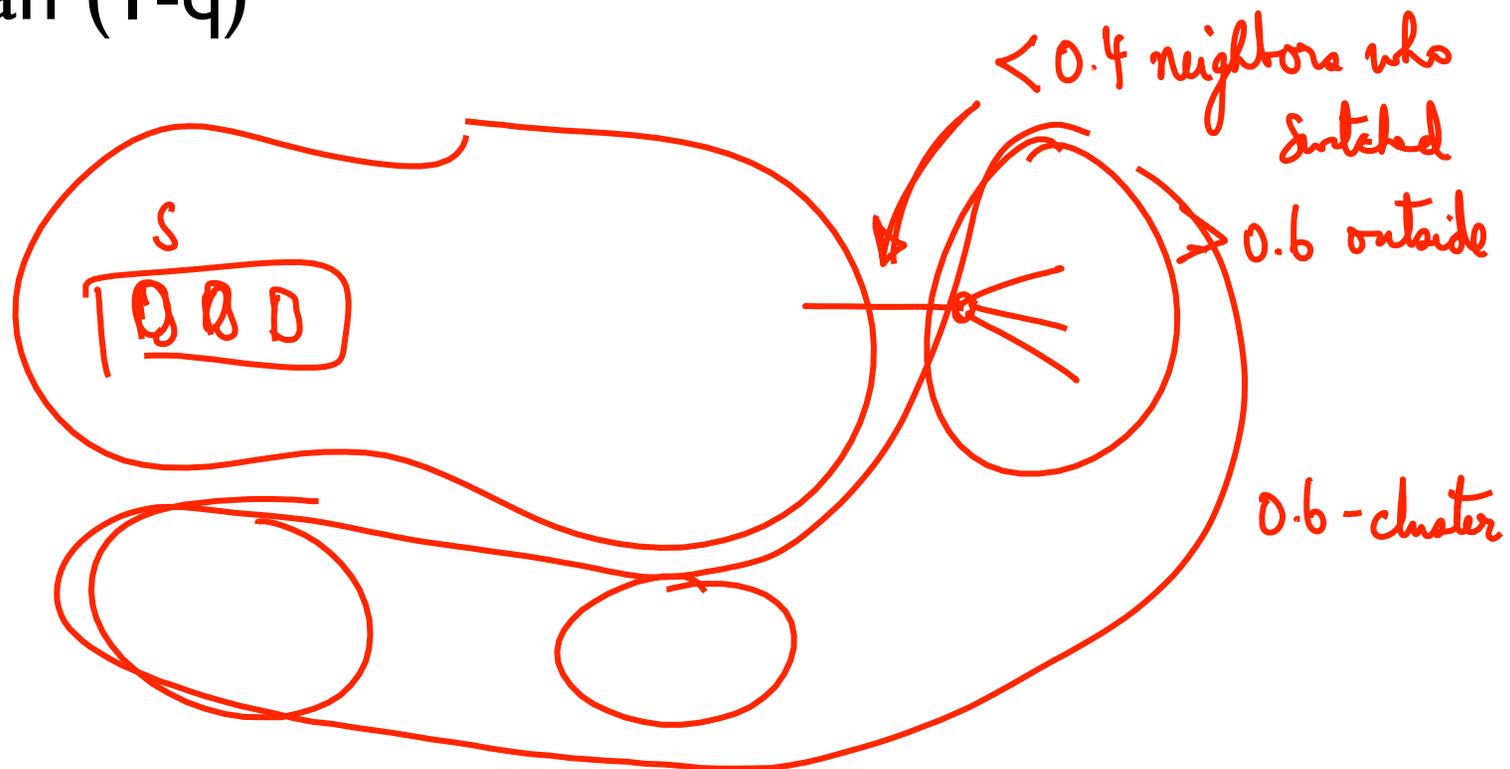
Clusters block Cascades

- Initial adopters S with threshold q ; If the remaining nodes contain a cluster of density greater than $(1-q)$, no cascade



No Cascade implies Dense Cluster

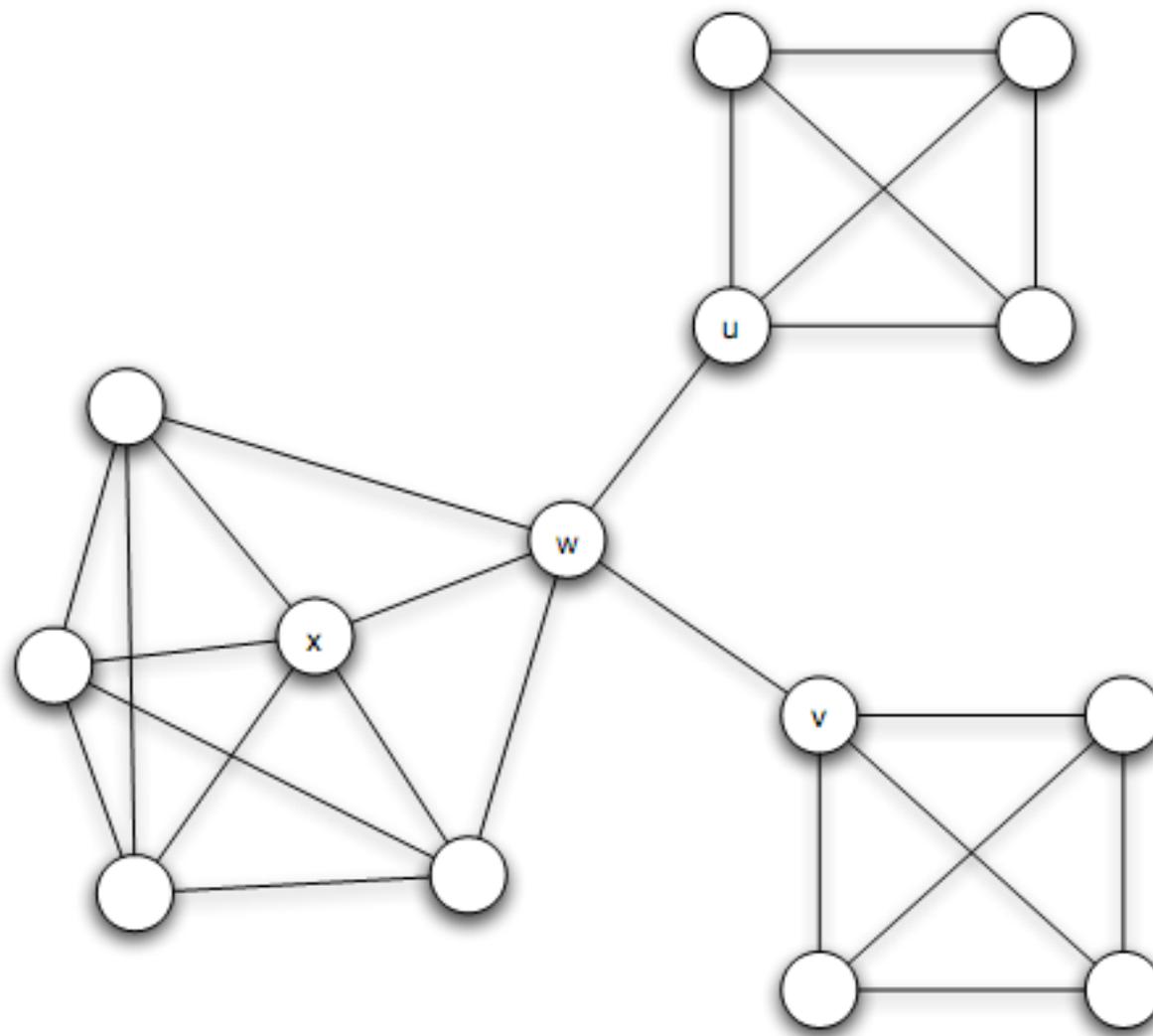
- When the set of initial adopters S with threshold q does not cause cascade, remaining network contains a cluster of density greater than $(1-q)$



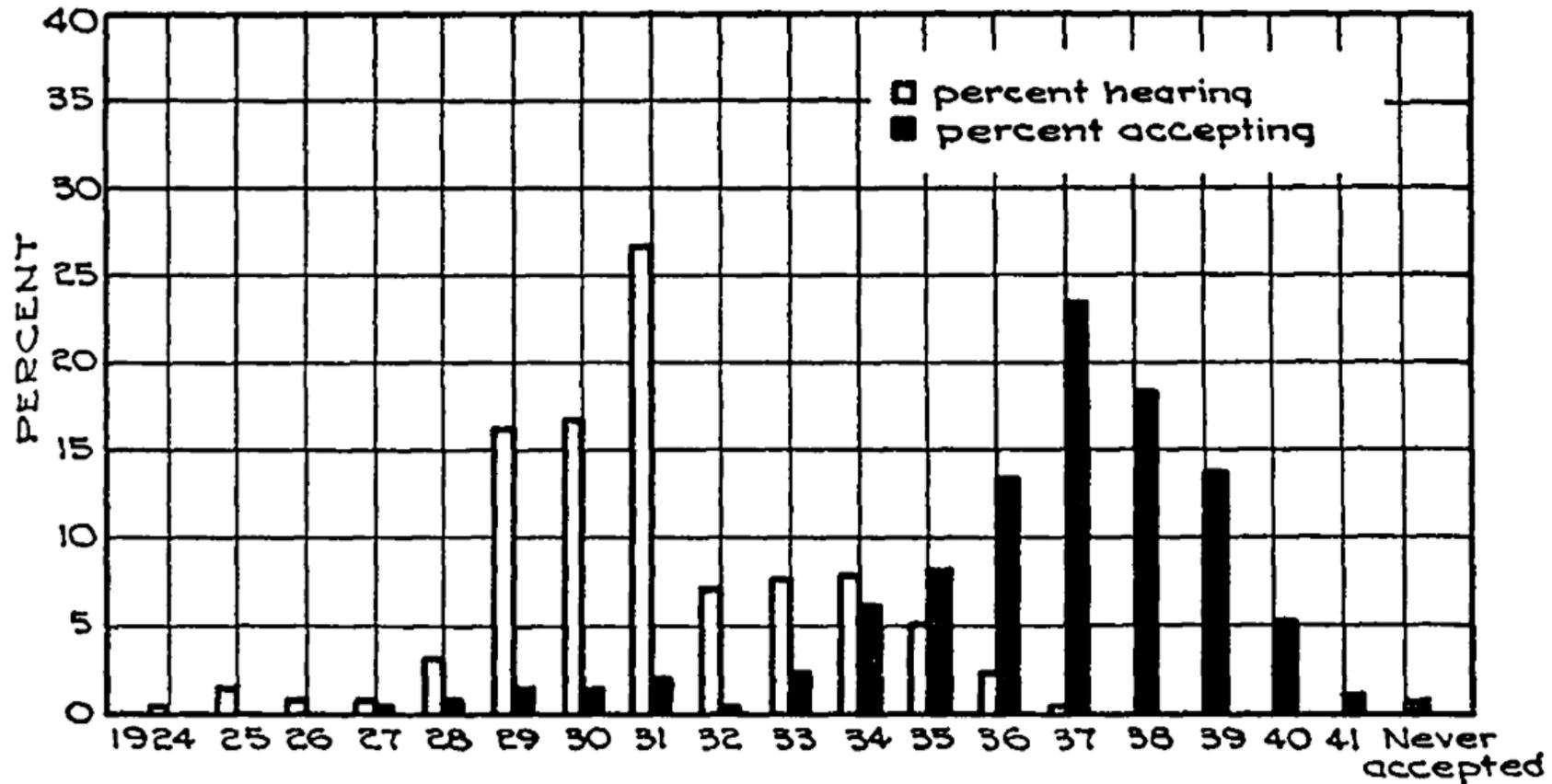
q-Cascades iff no $(1-q)$ Clusters

- (necessary) If no cascade, there is a $(1-q)$ -dense cluster in the remaining nodes
- (sufficient) If $(1-q)$ -dense cluster in remaining nodes, no cascade

Adoption from w, x with $q = 1/2$



Adoption follows Awareness



Hybrid Seed Corn Adoption [Ryan & Gross]

- Spread awareness but not well-enough connected to spread cascades
- Useful in spreading knowledge; Less useful in spreading influence

E.g., Easy to spread jokes/videos over internet...
Harder to mobilize action: more geographic/
strong ties based [Centola & Macy]

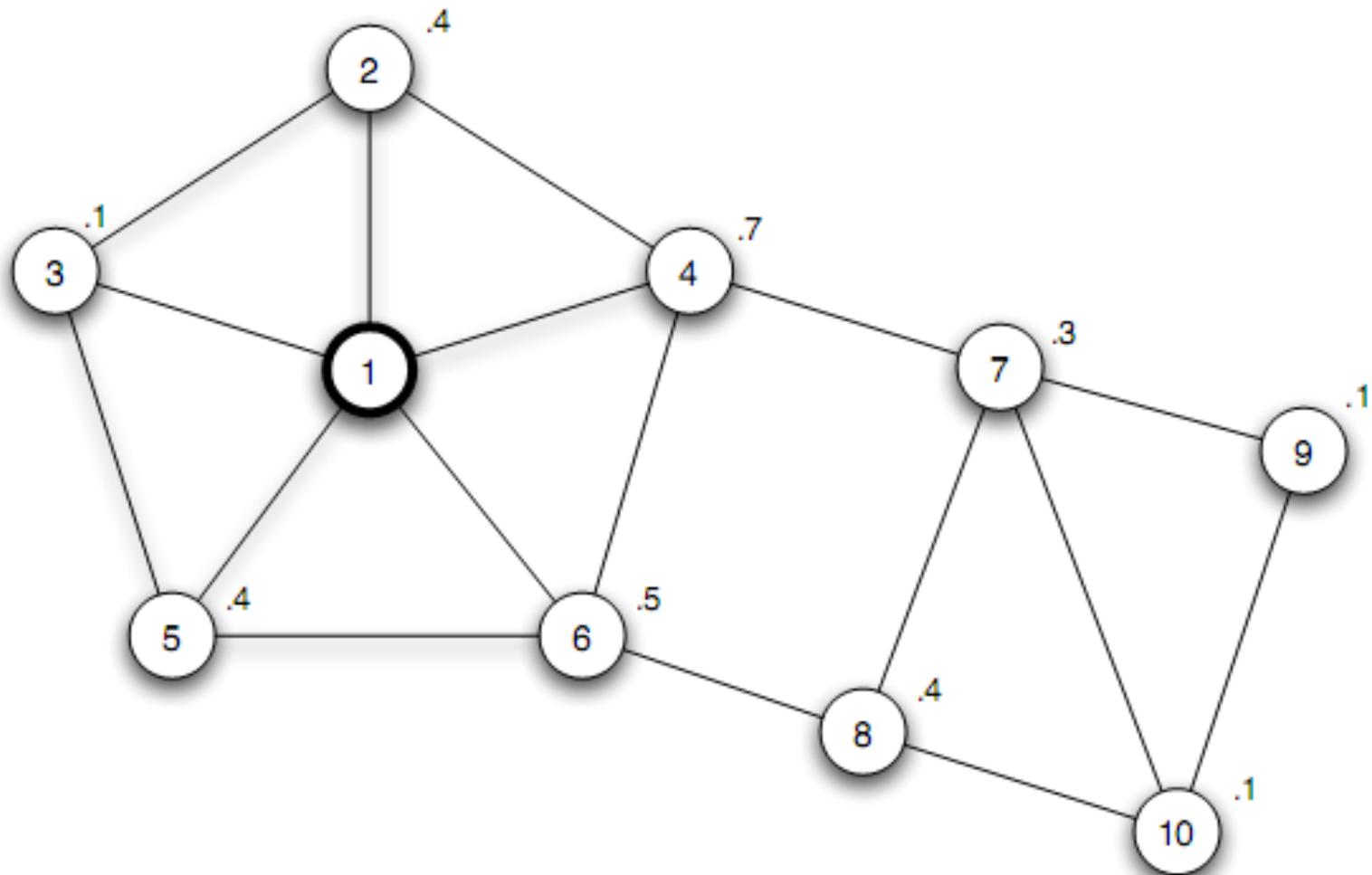
Generalized Payoffs

v \ w	A	B
A	a_v, a_w	0,0
B	0,0	b_v, b_w

v should adopt A over B if

$$p \geq b_v / (b_v + a_v) = q_v$$

Need centrality and gullible neighbors!



Set of nodes with individual thresholds, such that each node v in the set has more than $(1-q_v)$ fraction of its neighbors in the set

Fact: Adopters form a cascade iff the remaining nodes do not contain a blocking cluster