Task Routing for Prediction Tasks

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Eric Horvitz✓
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How do I prove this theorem?

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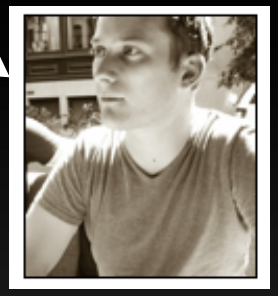
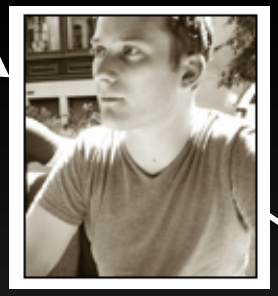
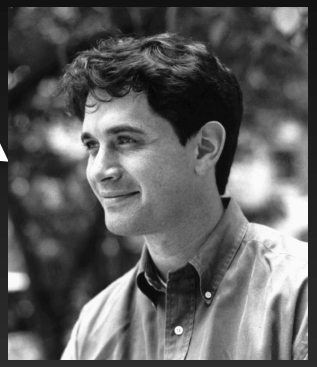
You need to reduce it to something…



How do I prove this theorem?

try Michael. He might know.





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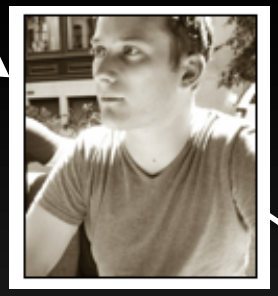
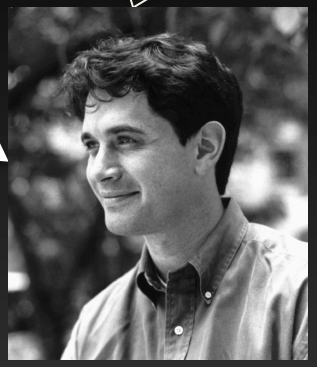
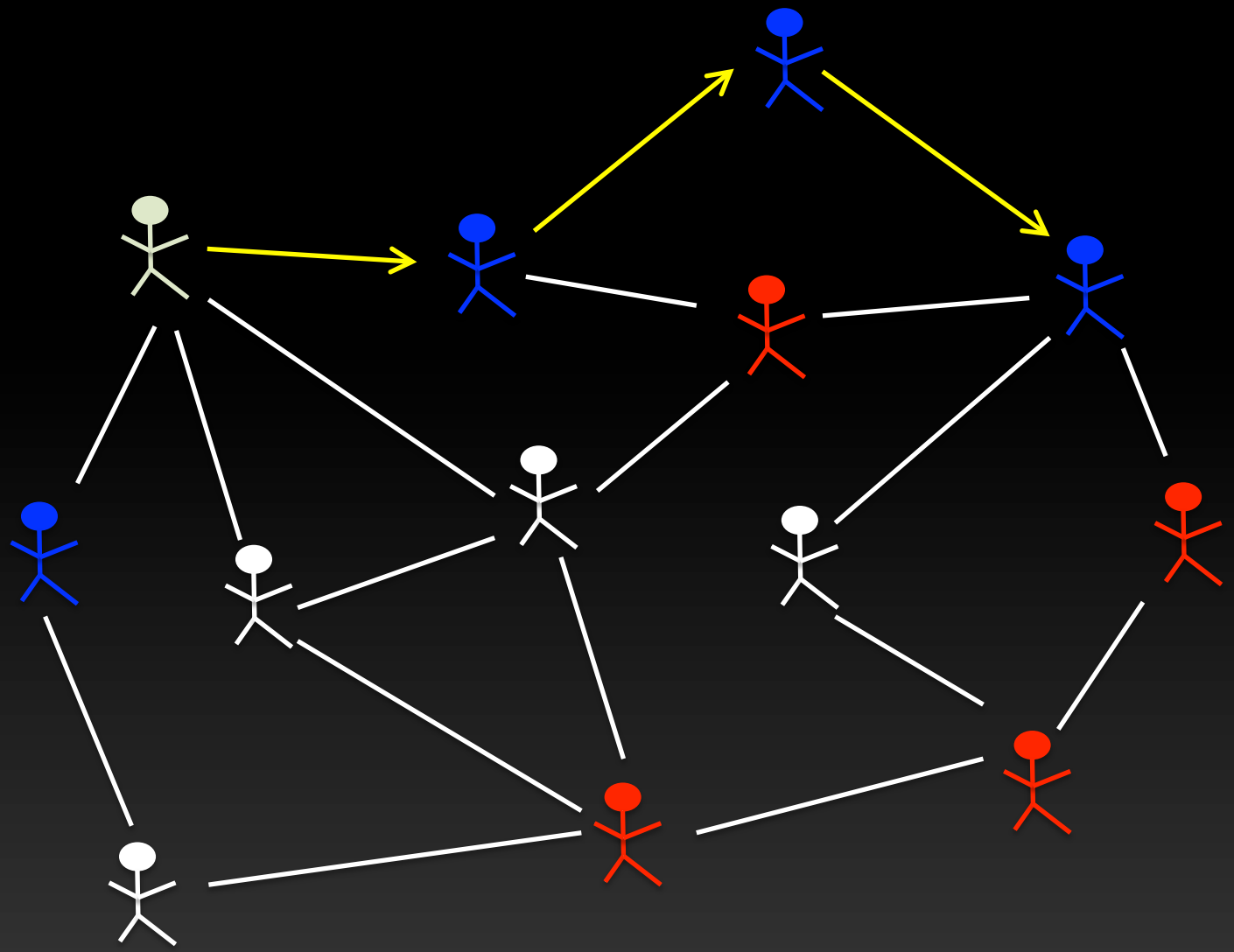


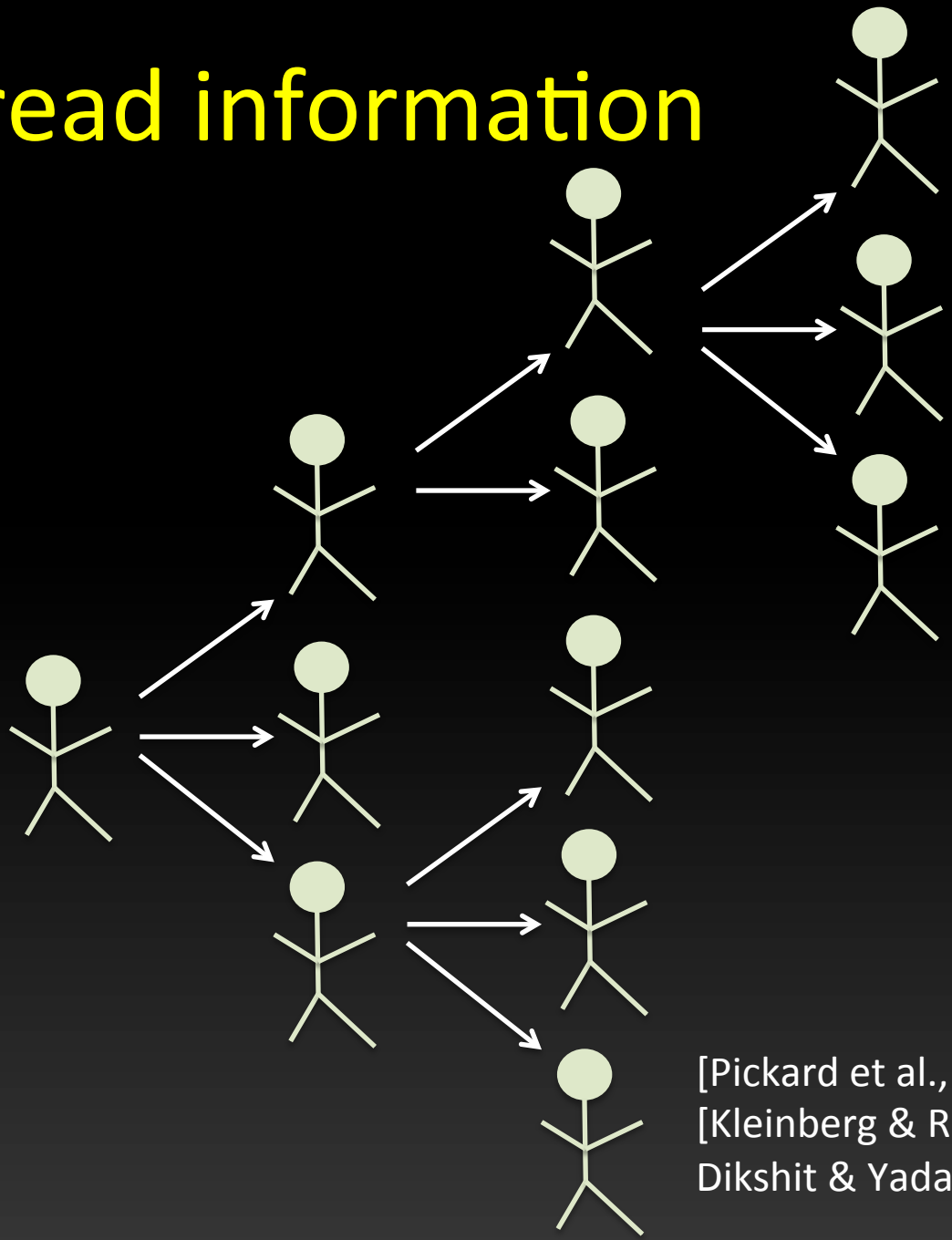
sometimes when you can't prove A or B, you need to prove C.



task routing over social networks

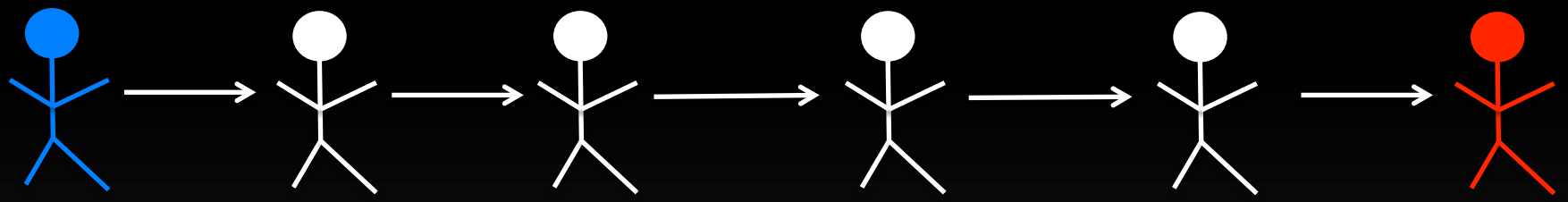


spread information



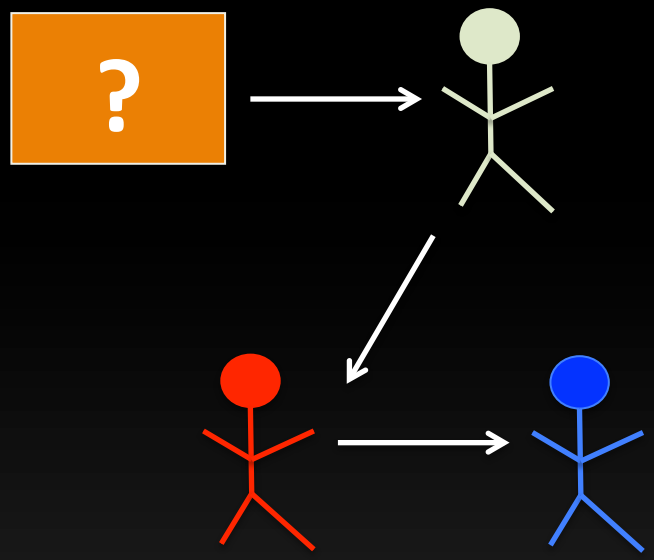
[Pickard et al., '10; Emek et al., '11]
[Kleinberg & Raghavan, ’05; Arcaute et al., ‘07; Dikshit & Yadati, ’09]

locate a target



[Travers & Milgram '69; Watts et al., ‘02; Dodds et al.,, '03; Kleinberg '06]

this talk: engaging experts



task routing for prediction tasks

task routing for prediction tasks

- ✧ will Obama win in 2012?
- ✧ will it rain in Valencia next week?
- ✧ will the Thunder win the NBA championships?

task routing for prediction tasks

Will Obama
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task routing for prediction tasks

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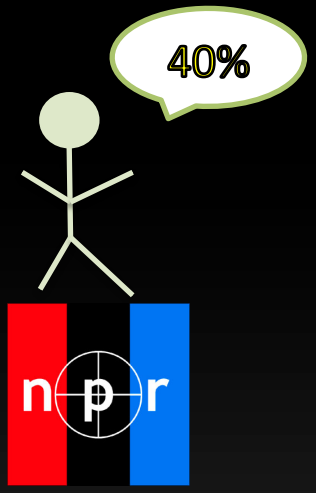

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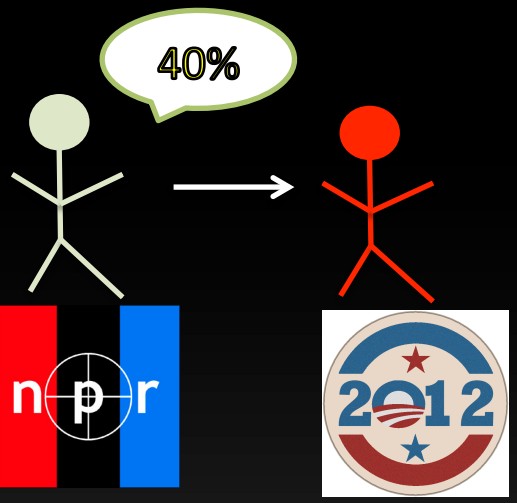

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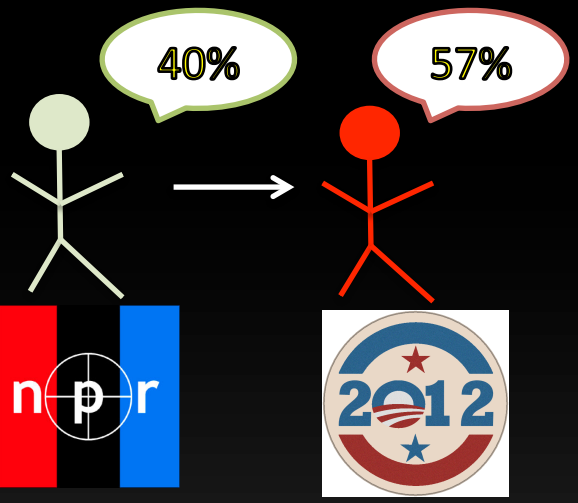

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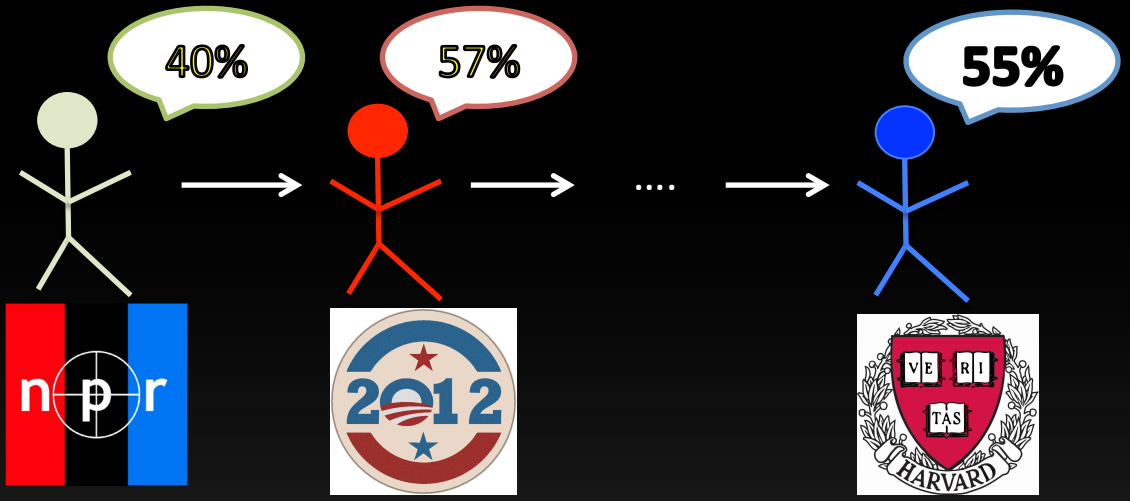

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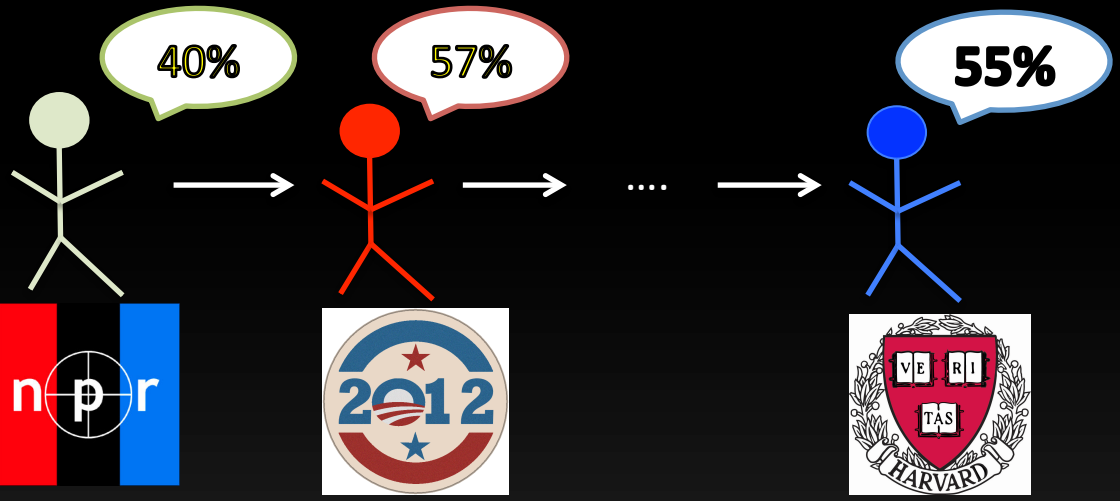
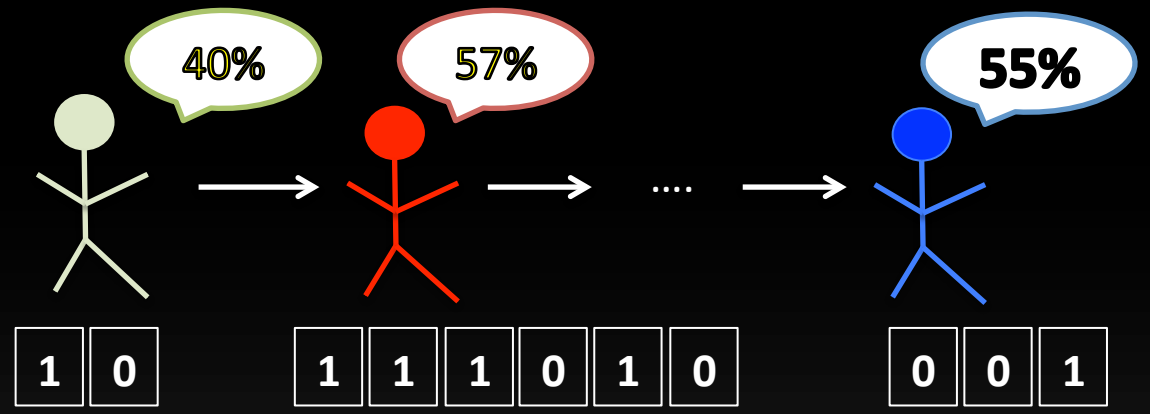


Design incentives such that in equilibrium:

- ✧ people report honestly
- ✧ people make good routing decisions

task routing for prediction tasks

Will Obama win in 2012?



task routing for prediction tasks

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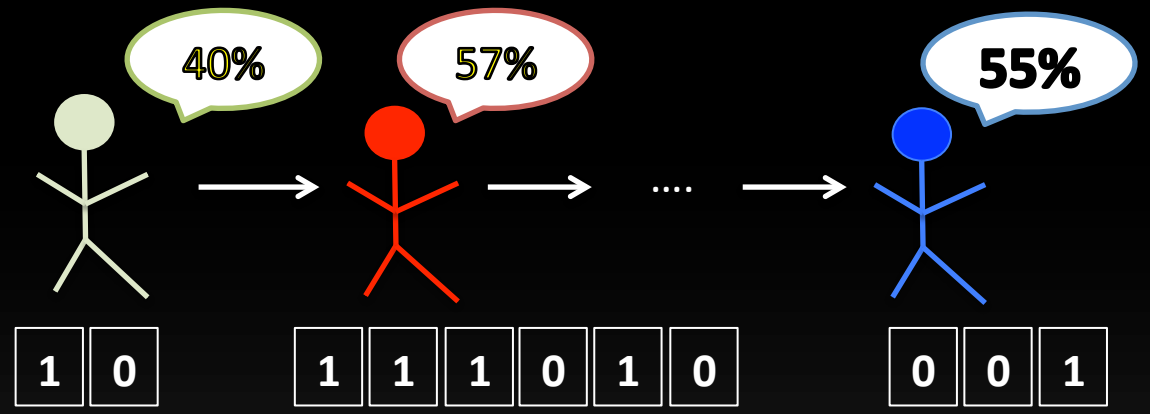
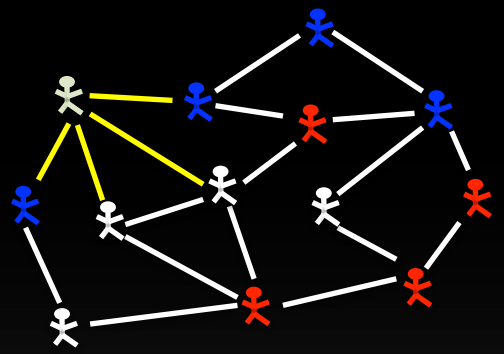


- players observe conditionally independent bits of signal based on true state
- Bayesian model; assume common prior and known signal distribution

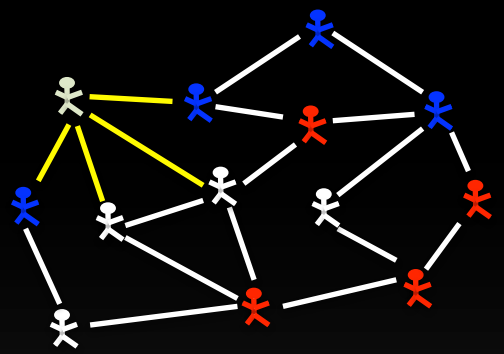
incentives



local knowledge of others' expertise

report honestly,
route effectively

incentives



report honestly,
route effectively

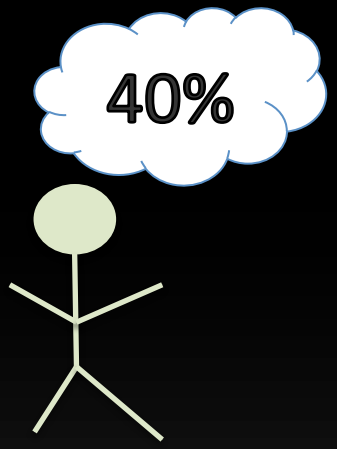
Local common knowledge

everyone knows how many bits of information people within *m*-hops hold, and this is common knowledge.

strictly proper scoring rules

[Good ‘52, Winkler ‘69, Savage ’71]

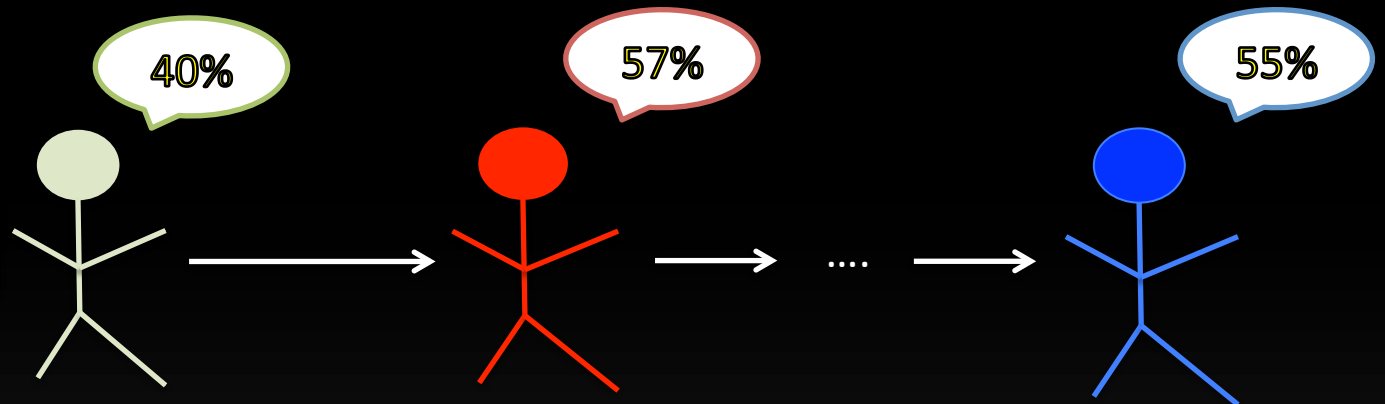
Will Obama win in 2012?



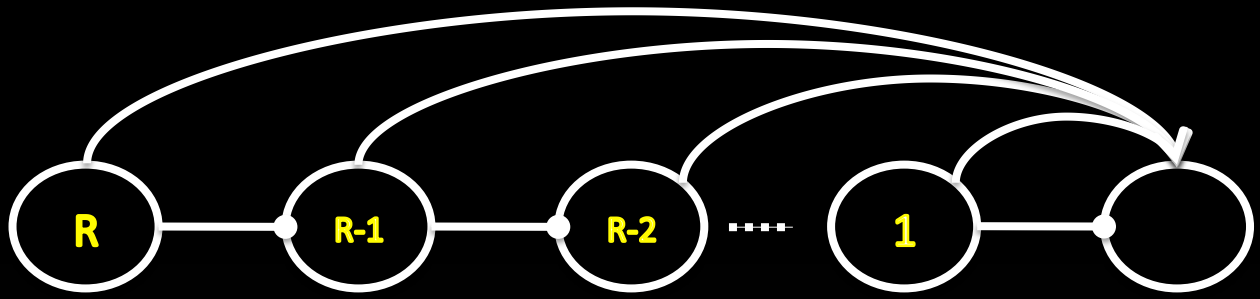
$$S(q) = \begin{cases} 1 - (1 - q)^2 & \text{if win} \\ 1 - q^2 & \text{if lose} \end{cases}$$

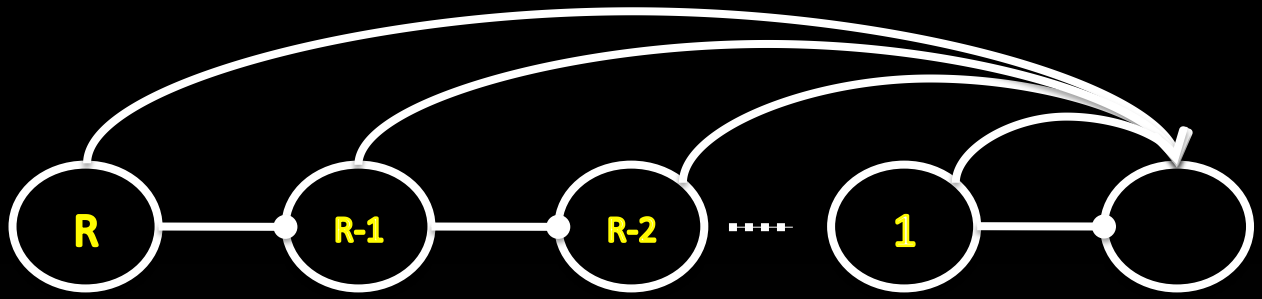
routing scoring rules

Will Obama win in 2012?



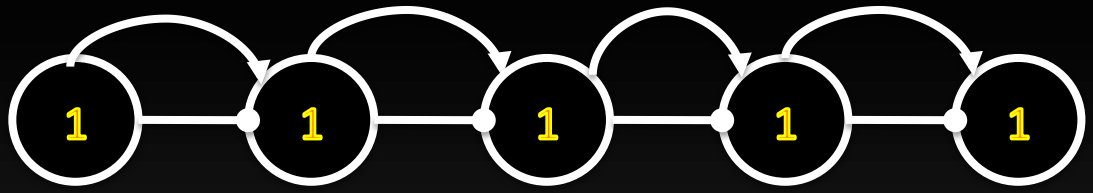
$$S(q_i) + S(q_{i+k})$$


R
R-1
R-2
1

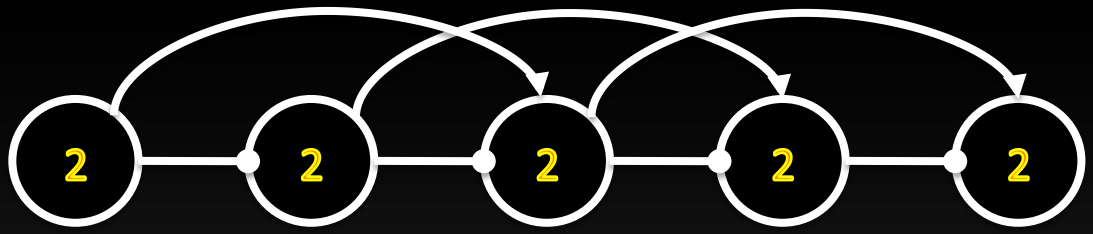


- people may only know others' expertise within a local neighborhood.

myopic routing rule



2-2-2-2



2-1-2-1

local routing scoring rules

Definition: Routing scoring rules for which each player's routing payment depends only on information within *m*-hops.

Theorem

Local routing scoring rules induce equilibrium in which players report honestly and route based on local information.

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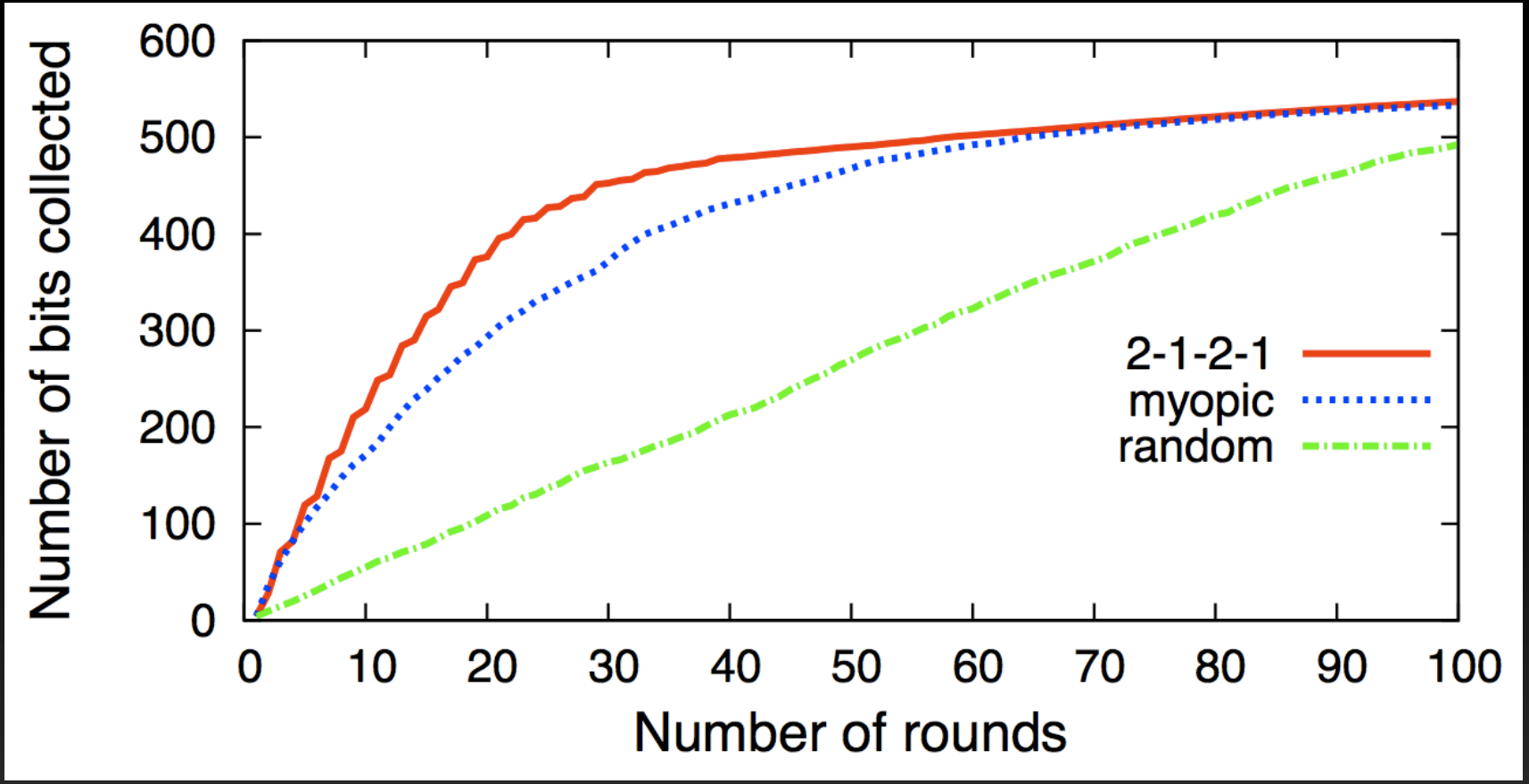
Local routing scoring rules induce equilibrium in which players report honestly and route based on local information.

Local routing scoring rules are the only routing scoring rules with this property.

benefit of local routing scoring rules



[graphs generated using the Watts-Strogatz model, with β = 0.1, n= 100, d = 10]

Conclusion

- Routing scoring rules incentivize contributions via solving and routing
- Local routing scoring rules explicitly enable equilibrium behavior for which agents' inference is tractable
- Numerous future work at task and organization level

thank you

Questions,
Comments

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