

CS-103 Announcements

- HW9 due 9pm Mon Nov 20
- Instead of lab quiz, there will be project
 - **Nov 30: JavaScript I.** Choose public JavaScript utility and modify for use in your own website.
 - **Dec 7: JavaScript II.** Based on classmate recommendations, choose another public JavaScript utility and modify for use in your own website.

HW9 Status

Wikipedia.org: 40

AltaVista.com: 2

LifeWithoutSurfing.Blogspot.Com: 1

Extra Credit Project

- ***BU Today* is launching “best blog @ BU” contest**
- **Open to students, faculty, staff**
- **They are looking for marketing advice: how to get the word out to the BU community**

Enhancements to SIR model

- Enhancements to SIR model that we brought up in class...
 - Structure of relationships
 - Countermeasures against infection

Enhancements to SIR model

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 - Structure of relationships
 - Countermeasures against infection
 - **Inherent resistance to infection**

Percolation Theory

- Developed to study physics of *gelation*—related to phase transition
- Models both
 - Susceptibility of individual node to infection
 - Likelihood of infection crossing between specific pair of nodes

Percolation: Sites and Bonds

Site (or vertex)

- Each site is either *susceptible* or not
- Occupation probability = probability that site is susceptible

Bond (or edge)

- Each bond is either *open* or *closed*
- Infectiousness = probability that bond is open

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Disease spreads along *open bonds* between *susceptible sites*

Percolation and Epidemics



High occupation
probability and
infectiousness



Lower
infectiousness



Lower
occupation
probability

Figure 8.11. Percolation on a network. Solid circles (links) correspond to occupied (open) sites (bonds). Connected clusters are shaded.

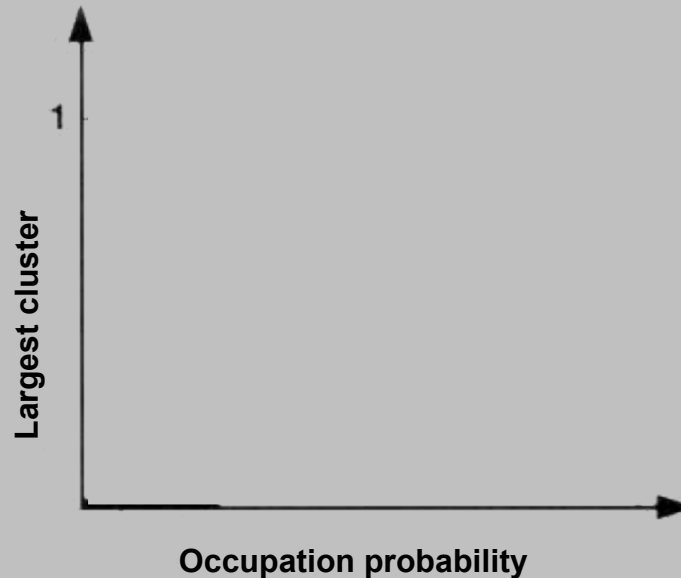
Percolating Cluster

- Possibility of epidemic depends on existence of *percolating cluster*, defined as

single cluster of susceptible sites connected by open bonds that permeates entire population

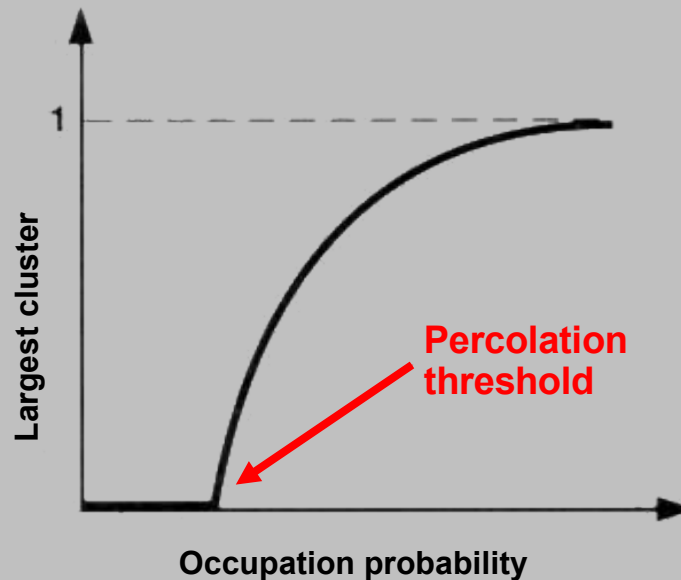
Site Percolation

- Assume all bonds are open
- How does size of largest cluster depend on occupation probability?



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Bond Percolation

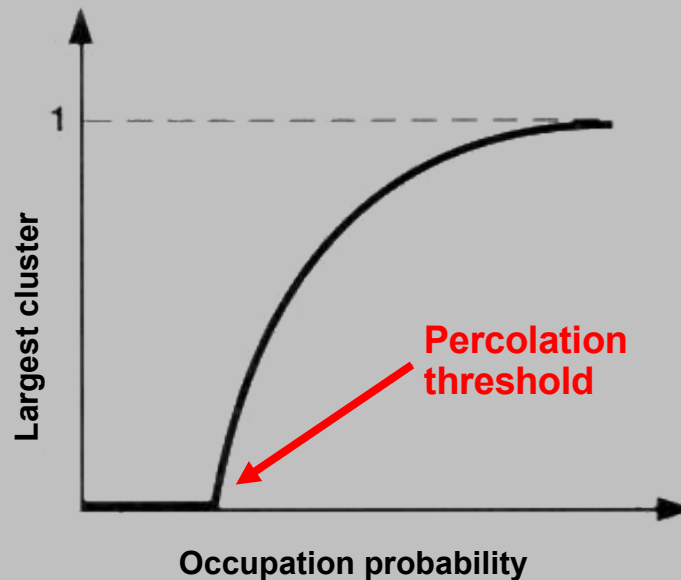
- Assume all sites are susceptible
- How does size of largest cluster depend on probability of open bonds?

Site vs Bond Percolation

- Modeling either alone is OK; modeling both simultaneously is very hard
- Important to choose Site vs Bond percolation model appropriately
 - Ebola
 - Melissa computer virus

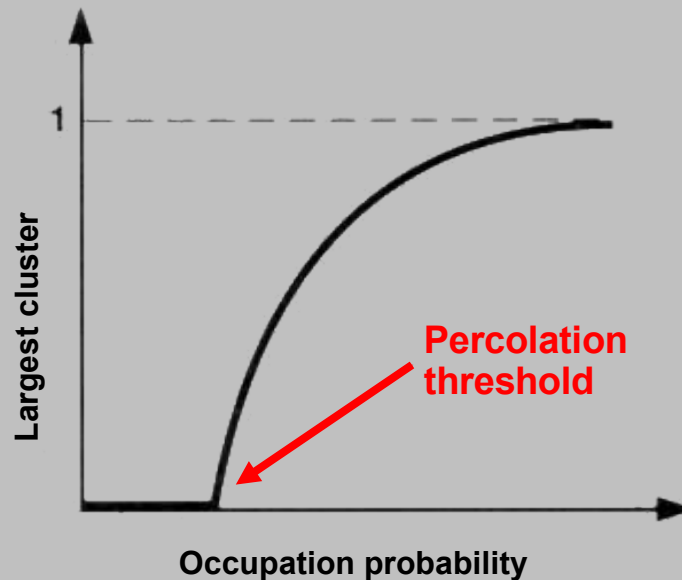
Implications for Microsoft PCs

- For a virus that depends on Windows, Outlook, and/or Internet Explorer, what is occupation probability?



Implications for Apple

- For a virus that depends on OS X or Safari, what is occupation probability?



Failures and Robustness

- We have looked at epidemics in
 - random networks
 - periodic lattices
 - small world networks
- What about scale-free networks?