What Should I Expect?
CS 4300 – 2nd Midterm

- Probability
- Probability
- Reasoning with Bayesian Networks
- Learning Probabilities
Possible Problem Styles

- In a cavern, an adventurer feels a breeze. He is standing in a corner next to 2 unexplored cells. Each cell has a 25% chance of containing a pit.

- What is the probability that the cell above contains a pit?

- What about the cell to the right?

- What about both cells?
Possible Problem Styles

• Joe has 3 coins. One is red, one is blue and one is green. They have 25%, 50% and 75% of landing heads, respectively. Calculate the following:
  • \( P(r=h), P(r=t \land g=h), P(r=t \mid b=h), P(g=h \lor b=h) \)
  • \( P(2 \text{ heads}), P(> 1 \text{ heads}), P(2 \text{ heads} \mid r=h) \)
  • Etc.
Possible Problem Styles

- A certain disease can cause baldness and/or obesity. The situation is summarized in the BN and CPT shown. Answer the following questions:
  - $P(!d)$, $P(d)$, $P(b)$, $P(!b)$
  - $P(b|d)$, $P(b|!d)$, $P(!b|d)$, $P(!b|!d)$
  - $P(b|o)$, $P(b|!o)$, $P(b|o^d)$
  - Etc.
Bayesian Network

P(d) = 0.3

P(b) =
- T: 0.6
- F: 0.4

P(o) =
- T: 0.8
- F: 0.5

Disease

Bald

Obese
Possible Problem Styles

- A certain disease can be caused by hereditary or environmental issues. The situation is summarized in the BN and CPT shown. Answer the following questions:
  - $P(h), P(!h), P(e), P(!e)$
  - $P(d), P(!d), P(d|h), P(d|h^e), P(d|!h)$
  - $P(h|d), P(h|d^e), P(h|e), P(h|!e), P(!h|e^d)$
  - Etc.
Bayesian Network

<table>
<thead>
<tr>
<th>h</th>
<th>e</th>
<th>P(d)</th>
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<tbody>
<tr>
<td>T</td>
<td>T</td>
<td>0.8</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
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</tr>
<tr>
<td>F</td>
<td>T</td>
<td>0.7</td>
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<tr>
<td>F</td>
<td>F</td>
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Possible Problem Styles

• The surprise candy company produces lime and cherry candies. They sell bags of candy mixed with lime and cherry. There are 3 varieties, 75/25, 50/50, and 25/75 where the first number is percentage cherry. The production is 40%, 35%, and 25% of the respective bag types. All candies are wrapped in opaque wrappers. All bags are marked identically, and contain a very large number of candies. You buy a bag and draw 5 candies: lime, lime, cherry, lime, cherry:

• P(b=75/25)?, P(next=lime)?, etc.
Possible Problem Styles

• Given SPAM/HAM data, classify messages.
• Use Maximum Likelihood
• Use LaPlace Smoothing