Today

- Exam 3 overview
- Ant (cont.)
- Estimation (cont.)

Reading (Reminder)

- Ch 6.5
- Ch 8 – 11 (Testing)

Homework

- HW 7 due Thurs.
- Proj part 9 due Thurs. (testing)
Exam Overview

Basics
• Closed book, closed notes
• Worth 10% of your final grade

Topics
• Test-driven development
• More velocity, iterations, etc.
• Some testing
• Ant / Build management
• More on estimation
Comparing to Actual Results

Track estimates and compare to what happens to become a better estimator

- monitor how your estimates are “improving” over time

“Magnitude of Relative Error”

\[
\text{MRE} = \left| \frac{(\text{Actual} - \text{ExpectedCase})}{\text{Actual}} \right|
\]

- calculate for each feature (story)
- also check if estimate is in the best–worst range
- can average MRE (Mean MRE, or MMRE) across stories

Example:

<table>
<thead>
<tr>
<th>Feature</th>
<th>BestCase</th>
<th>MostLikely</th>
<th>WorstCase</th>
<th>ExpectedCase</th>
<th>Actual</th>
<th>MRE</th>
<th>In best–worst?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feature 1</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>2.2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feature 2</td>
<td>1</td>
<td>2</td>
<td>4.5</td>
<td>2.3</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feature 3</td>
<td>0.5</td>
<td>1</td>
<td>3</td>
<td>1.0</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feature 4</td>
<td>1</td>
<td>1.5</td>
<td>3</td>
<td>1.7</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feature 5</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>3.3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>4.5</td>
<td>9.5</td>
<td>21.5</td>
<td>10.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- assume these are the “actuals” from exercise
- compute MRE, MMRE, and whether in range

\[\ldots\text{MMRE}\]
Estimation (cont.)

Estimation questions …

• Why worry about accurate estimates?
• Where do estimation errors come from?
• How should estimates be presented?
• What is being estimated?

Two main goals in presenting estimates:

• communicate uncertainty clearly
• maximize chances estimates will be used constructively and appropriately

Plus-or-Minus Qualifiers

“6 months ± 2 months”

– ± indicates the amount and direction of uncertainty

“6 months + 1/2 month, − 1/2 month”

– says the estimate is very accurate
– and there is a good chance of meeting the estimate

“6 months + 4 months, − 1 month”

– says the estimate isn’t very accurate
– and there is less of a chance of meeting the estimate
Typically make ± qualifiers large enough to include:

- **one standard deviation** on each side of the “core” estimate
- the core estimate would be the expected case (50% likely)
- this means there is still a **16% chance** of going over schedule
- and a **68% chance** of being within the range

*Of course, this assumes your estimates are good!*

Can also use “within some percentage” instead of ±

“6 months within 25%”
- in other words: 6 months ± 1.5 months

**Q: What are weaknesses of the ± style?**

- while some uncertainty is given, unclear at what level
  - e.g., “6 months ± 1.5 months” ... is 7.5 months 84% likely?
- as the estimate is passed through organization ...
  - tends to get stripped down to just the core (single-point) estimate
  - this would be bad, since this is probably only 50% likely!
  - may happen to remove variability, or because only setup to handle single-point project estimates
Risk Quantification

Combine ± qualifiers and estimate assumptions

- i.e., attach specific impacts to risks
- targeted at non-technical stakeholders
- should be “large-grained” risks (aggregated)

Estimate: 6 months + 5 months, -1 month

<table>
<thead>
<tr>
<th>Impact</th>
<th>Description of Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>+1.5 months</td>
<td>Nees more than 20% new features over prior version</td>
</tr>
<tr>
<td>+1 month</td>
<td>Graphics formatting subsystem delivered later than planned</td>
</tr>
<tr>
<td>+1 month</td>
<td>Cannot reuse 80% of database code from previous version</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>-0.5 months</td>
<td>All developers assigned 100% to project by April</td>
</tr>
<tr>
<td>-0.5 months</td>
<td>New development tools work better than planned</td>
</tr>
</tbody>
</table>

Q: Which is better ... ranges or percent confidence? Why?

- e.g.: “6 months ± 1 month” or “7 months at 84% confidence”

- if you can, use ranges, percent confidence, and risk quantification
- if not, typically ranges (if your range won’t become a single-point estimate)
- otherwise percent confidence
Example

The base schedule estimate is 6 calendar months, which we believe is accurate to within 25%. This estimate can be used as the basis for the project budget but not for making external commitments. The estimate is based on the following assumptions.

1. The three key technical leaders will be assigned 100% to the project on March 15.
2. All development and test staff will be assigned 100% to this project by April 15.
3. Graphics-formatting subsystem will be delivered by subcontractor with acceptable quality by August 1.
4. No updates in the business rules will be required.
5. Extent of required integration with the FooBar system is unknown. This estimate has allocated
6. 250 staff hours for that integration work. If more work is required, the whole-project estimate will need to be increased.
7. No more than 5 new reports will be required.
8. New development tools will produce an improvement in productivity of 20% or more compared to past projects.
9. Staff will use fewer sick days than average because most of the project occurs during the summer months.
10. The project will be able to reuse at least 80% of the database code from Version 2.0 without modifications

If these assumptions change, this estimate will need to be revised.