UNIFIED CODE COUNT (UCC)
ARR 2015

USC CSSE
Anandi Hira, Hnanadi Mardah, Shreyas Sharma
What is UCC?

- Counts lines of code in software source files
- Key counting capabilities
  - Physical/Logical SLOC
  - Blank Lines, Comments
  - Compiler Directives, Executable Instructions
  - Keywords
  - Cyclomatic Complexity
  - Differencing
  - Duplicates
  - Custom extensions
Operational Concepts

**USC DR Students**
- 40-50 Graduate students
- 5-10 hours/week
- 5 – 8 projects per semester
  - Added Functionality
  - Additional Metrics
  - New Language Support
  - Maintenance
  - Integration
  - Process Improvement

**The Aerospace Corporation**
- Evaluate code for buffer overflows and vulnerabilities
- Work closely with client to pass security filters, making required changes
- Independent Verification & Validation
# UCC Development and Deliverables

## Development Phases
- Research and Documentation
- Implementation and Testing
- Extensive Testing and Documentation
- Integration and System Testing

## Semester Deliverables
- Timesheets (hours)
- Project Plan
- Weekly Status Reports
- Source Code
- Test Cases
- Test Code
- Final Report
UCC Data Analysis Process

- Gather, Organize Deliverables
- Determine Collectable Factors
- Formulate Dataset
- Analyze
- Identify Groups
COCOMO® II Comparison

- **FLEX = Low**
  - Conformance with pre-established requirements

- **ACAP = Low**
  - Low-level understanding of high-level requirements/effects

- **PCON = Very Low**
- **PLEX = Low**
- **TOOL = Very Low**
  - Edit, Code, Debug
Documentation Effort

Project Total Effort

\[ y = 67.918x - 66.467 \]
\[ R^2 = 0.93545 \]

- Project Total Effort (hours)
- Linear (Project Total Effort (hours))
Documentation Linear Regression

\[
\text{Effort} = 372.602 + 23.699 \times \# \text{of Project Report Pages}
\]

<table>
<thead>
<tr>
<th>Source</th>
<th>Value</th>
<th>( T )</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>372.602</td>
<td>4.139</td>
<td>0.001</td>
</tr>
<tr>
<td>Project Report</td>
<td>23.699</td>
<td>2.007</td>
<td>0.066</td>
</tr>
</tbody>
</table>

0.000 200.000 400.000 600.000 800.000 1000.000 1200.000

0.000 5.000 10.000 15.000 20.000 25.000

- **Project Total Effort (hours)**
- **Predicted Linear Regression**
IDPD Observation

Normalized Productivity vs Total SLOC/Effort hours

- MIPS
- GUI
- Matlab
- Word/Text

Semester:
1 2 3 4 5 6

Normalized Productivity:
0 0.2 0.4 0.6 0.8 1.0 1.2

Total SLOC/Effort hours:
0 0.2 0.4 0.6 0.8 1.0 1.2
## IDPD Factor Statistics

<table>
<thead>
<tr>
<th>IDPD Factor %</th>
<th>With no Test-only Semester</th>
<th>With Test-Only Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td>2 semesters</td>
<td>37.5344</td>
<td>34.1349</td>
</tr>
<tr>
<td>3 semesters</td>
<td>44.6844</td>
<td>43.3956</td>
</tr>
</tbody>
</table>

### F-value and p-value

<table>
<thead>
<tr>
<th>IDPD Factor %</th>
<th>F-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 semesters</td>
<td>5.0656</td>
<td>0.0481</td>
</tr>
<tr>
<td>3 semesters</td>
<td>6.7635</td>
<td>0.0265</td>
</tr>
</tbody>
</table>
FUTURE STEPS AND ANALYSES

- Re-use SLOC
- Re-use SLOC calibration
- Re-use Documentation
- Group Analyses
- Test Data
- Defects
- Additional Factors:
  - ACAP
  - PCAP
  - SITE