ECE 449 - Object-oriented Programming and Computer Simulation


Enrollment: Elective course for EE majors; computer systems/software elective course for CPE majors.


Coordinator: J. Wang, Assistant Professor of ECE

Course goals:
After completing this course, the student should be able to do the following:
1. Identify objects and their interactions for computer simulation.
2. Utilize object lifetime for resource management considering object composition, inheritance, and exception handling.
3. Understand typical computer simulation algorithms.
4. Reuse existing class libraries to improve code quality and productivity.
5. Utilize class invariants to design class types. Document and validate pre-conditions and post-conditions via assertions.
6. Construct reusable class libraries using polymorphism.
7. Utilize design patterns when designing and reusing class libraries.
8. Design and implement a computer simulator following test-driven and iterative/incremental software engineering practices.

Prerequisites by topic:
1. Program flow control with branch/loop and functions.
2. Basic data structure including array and linked list.
3. Basic algorithms including sorting and recursion.
4. Familiarity with logic gates and computer organization.

Lecture schedule: Two 75-minute sessions per week
Laboratory schedule: None

Topics:
1. Introduction to C++ and computer simulation (1 week)
2. String and file I/O (1 week)
3. Abstract data types and functions (1 week)
4. Standard template library (2 weeks)
5. Class invariants and class design (1 week)
6. Resource management (1 week)
7. Object composition and exception safety (1 week)
8. Cycle simulation (1 week)
9. Inheritance and runtime polymorphism (1 week)
10. Design patterns (1 week)
11. Event-driven simulation (1 week)
12. Templates and compile-time polymorphism (1 week)
13. Smart pointer (1 week)
14. Final Exams (1 weeks)
Computer usage: Students use standard-conforming C++ compilers to complete the projects that build a computer simulator for digital circuits.

Laboratory topics: None

Relationship of ECE 449 Course Goals to Student Outcomes:

<table>
<thead>
<tr>
<th>Student Outcomes:</th>
<th>Course Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>a  Apply knowledge of math, engineering, science</td>
<td>1,2,3,4,5,6,7,8</td>
</tr>
<tr>
<td>b  Design and conduct experiments /Analyze and Interpret Data</td>
<td>5,8</td>
</tr>
<tr>
<td>c  Design system, component, or process to meet needs</td>
<td>2,4,5,6,7,8</td>
</tr>
<tr>
<td>d  Function on multi-disciplinary teams</td>
<td></td>
</tr>
<tr>
<td>e  Identify, formulate, and solve engineering problems</td>
<td>3</td>
</tr>
<tr>
<td>f  Understand professional and ethical responsibility</td>
<td></td>
</tr>
<tr>
<td>g  Communicate effectively</td>
<td></td>
</tr>
<tr>
<td>h  Broad education</td>
<td></td>
</tr>
<tr>
<td>i  Recognize need for life-long learning</td>
<td></td>
</tr>
<tr>
<td>j  Knowledge of contemporary issues</td>
<td></td>
</tr>
<tr>
<td>k  Use techniques, skills, and tools in engineering practice</td>
<td>4,5,6,7,8</td>
</tr>
</tbody>
</table>

Prepared by: J. Wang                  Date: October 15, 2013