

软件工程综合实践 教学大纲

Software Engineering Studio Subject Syllabus

一、课程信息 Subject Information

课程编号: Subject ID	3100214003.01	开课学期: Semester	3
课程分类: Category	专业教育 PA	所属课群: Section	综合实践 PA
课程学分: Credit Points	3	总学时/周: Total Hours/Weeks	48
理论学时: LECT. Hours	48	实验学时: EXP. Hours	0
PBL 学时: PBL Hours	0	实践学时/周: PRAC. Hours/Weeks	0
开课学院: College	东北大学 悉尼智能科技学院	适用专业: Stream	计算机科学与技术 CST
课程属性: Pattern	必修 Compulsory	课程模式: Mode	引进 UTS
中方课程协调人: NEU Coordinator	程绍辉张旭 S. Cheng X. Zhang	成绩记载方式: Result Type	百分制 Marks
先修课程: Requisites	无 none		
英文参考教材: EN Textbooks	无 None		
中文参考教材: CN Textbooks	无 None		
教学资源: Resources	https://lms.cloudcampus.com.cn/courses/30		
课程负责人(撰写人): Subject Director	程绍辉张旭 S. Cheng X. Zhang	提交日期: Submitted Date	单击或点击此处输入日期。
任课教师(含负责人): Taught by	程绍辉张旭 S. Cheng X. Zhang		
审核人: Checked by	韩鹏	批准人: Approved by	史闻博
		批准日期: Approved Date	单击或点击此处输入日期。

二、教学目标 Subject Learning Objectives (SLOs)

注：毕业要求及指标点可参照悉尼学院本科生培养方案，可根据实际情况增减行数

Note: GA and index can be referred from undergraduate program in SSTC website. Please add/reduce lines based on subject.

<p>整体目标: Overall Objective</p>	<p>软件系统深深植根于广泛的行业和企业中，非常普遍，以至于在软件缺陷出现之前，我们往往不知道它的存在。一个 bug 就可能导致严重的软件故障，从而造成巨大的社会和经济影响。尽管在提高软件可靠性和安全性方面越来越受到重视和努力，但现代复杂系统（例如，包含数百万行代码）仍然存在漏洞。</p> <p>本课程旨在开发基于开源框架的自动化软件分析技术，以了解和发现系统软件中常见但重要的软件缺陷和缺陷。通过本课程，学生将有机会应用和实践他们的系统编程技能和软件开发经验。特别是，学生们将设计和开发自动代码分析工具，以理解、发现和检测编程错误，从而提高软件质量。评估学生的依据是他们的技术能力、通过开源软件开发对软件分析的理解，以及他们在口语和写作方面的沟通技能、团队合作技能。</p> <p>Software systems, which are deeply rooted in a wide range of industries and businesses, are so pervasive that we are often unaware of its presence until software bugs occur. A single bug can cause critical software failures, resulting in huge social and economic impacts. Despite the increasing attention and efforts in improving software reliability and security, modern complex systems (e.g. containing millions of lines of code) are still plagued with bugs.</p> <p>This subject aims to develop automated software analysis techniques based on an open-source framework to understand and discover common yet important software bugs and defects in system software. Through this subject, students will be given opportunity to apply and practice their system programming skills and software development experience. Particularly, the students will design and develop automated code analysis tools to understand, discover and detect programming errors to improve software quality. Students are assessed on the basis of their technical capabilities, understanding of software analysis via open-source software development, and their communication skills in speaking and writing, their team-working skills.</p>	
<p>(1) 专业目标: Professional Ability</p>	<p>1-1</p>	<p>确定、参与、解释和分析利益相关者的需求和文化观点，确定优先事项和目标，并确定约束、不确定性和风险（社会、道德、文化、立法、环境、经济等），以定义系统要求。graduates identify, engage, interpret and analyse stakeholder needs and cultural perspectives, establish priorities and goals, and identify constraints, uncertainties and risks (social, ethical, cultural, legislative, environmental, economics etc.) to define the system requirements.</p>
	<p>1-2</p>	<p>应用问题解决、设计和决策方法来开发组件、系统和流程，以满足特定要求。</p>

		apply problem solving, design and decision-making methodologies to develop components, systems and processes to meet specified requirements.
	1-3	应用抽象、数学和学科基础、软件、工具和技术来评估、实施和操作系统。 apply abstraction, mathematics and discipline fundamentals, software, tools and techniques to evaluate, implement and operate systems.
	1-4	作为不同团队的有效成员或领导者,在跨学科和跨文化的工作环境中有效沟通和运作。 graduates work as an effective member or leader of diverse teams, communicating effectively and operating within cross-disciplinary and cross-cultural contexts in the workplace.
	1-5	批判性地自我评估自己的表现,以提高自己、团队以及更广泛的社区和社会。 critically self-review their performance to improve themselves, their teams, and the broader community and society.
(2) 德育目标: Essential Quality	2-1	软件程序设计与开发的过程中,应当遵守工程伦理的原则。 In the process of software programming and development, the principles of engineering ethics should be observed.
	2-2	认识到创新能力的重要性。 Students should realize the importance of innovation ability.

课程教学目标与毕业要求的对应关系 Matrix of GA & SLOs

毕业要求 GA	指标点 GA Index	教学目标 SLOs
1、工程知识：能够将数学、自然科学、工程基础和专业知用于解决复杂工程问题。 GA1. Engineering Knowledge: Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	指标点 1-2: 掌握程序设计、数据结构、算法分析与设计、计算机数字系统、操作系统等专业知识,具备计算机程序设计开发能力和计算机与信息系统设计开发与维护能力。 1-2: Mastery of programming, data structure, algorithms analysis and design, computer digital system, and operating system, etc., and capable of computer programming and design, design and maintenance of computer and information systems;	1-1, 1-2, 1-3,1-4
3、设计/开发解决方案：能够设计针对复杂工程问题的解决方案,设计满足特定需求的系统、单元或流程,并能够在设计环节中体现创新	指标点 3-1: 能够设计针对本专业相关复杂工程问题的解决方案,能够设计和开发实现特定功能、满足特定需求的计算机、软件或网络系统。 3-1: Capable of designing solutions to	1-3

<p>意识, 考虑社会、健康、安全、法律、文化以及环境等因素。</p> <p>Design/Development of Solutions: Design solutions for complex engineering</p>	<p>complex engineering problems related to the major, and capable of designing and developing computers, software or network systems that can function specifically and meet specific requirements.</p>	
<p>problems and design systems, components or processes that meet specified needs with appropriate consideration for public health, and safety, cultural, societal and environmental considerations.</p>	<p>指标点 3-3: 能够在设计和开发的各个环节中综合考虑社会、健康、安全、法律、文化以及环境等因素。</p> <p>3-3: Capable of taking social, health, safety, legal, cultural and environmental factors in consideration during all aspects of design and development.</p>	1-3, 2-1
<p>4、研究: 能够基于科学原理并采用科学方法对复杂工程问题进行研究, 包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论。</p> <p>Investigation: Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.</p>	<p>指标点 4-1: 能够基于科学原理并采用科学方法, 在本专业相关理论指导下对复杂工程问题设计实验进行研究。</p> <p>Capable of designing experiments and doing research on complex engineering problems based on scientific principles and scientific methods, under the guidance of related theories of the major.</p>	1-3, 2-2
<p>8、职业规范: 具有人文社会科学素养、社会责任感, 能够在工程实践中理解并遵守工程职业道德和规范, 履行责任。</p> <p>Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.</p>	<p>指标点 8-2: 了解本专业相关的职业道德与规范并认识其重要性, 具备良好的职业道德和社会责任感, 能够对工程实践活动的社会道德进行判断和评鉴, 并履行相应的责任;</p> <p>8-2: Understanding of the professional ethics and norms related to the major and recognize its importance, good professional ethics and social responsibility, capable of judging and evaluating the social ethics of engineering practice activities and fulfill corresponding responsibilities.</p>	2-1

三、教学内容 Content (Topics)

注: 以中英文填写, 各部分内容的表格可根据实际知识单元数量进行复制、扩展或缩减

Note: Filled in both CN and EN, extend or reduce based on the actual numbers of knowledge unit

(1) 理论教学 Lecture

知识单元序号: Knowledge Unit No.	1	支撑教学目标: SLOs Supported	1-1
知识单元名称 Unit Title	编码和调试技练习 practice coding and debugging skills		
知识点: Knowledge Delivery	<p>学生将通过在线幻灯片和资源练习他们的编码和调试技能。他们还将提供学习如何编写高效高质量软件的机会。为了练习基本编程元素，学生需要提交能够正确编译并输出所需输出的实现。</p> <p>The student will practice their coding and debugging skills through online slides and resources. They will also give opportunities to learn how to write efficient and high-quality software. To practice the basic programming elements, the student is expected to submit their implementation which can be correctly compiled and output the desired outputs.</p>		
学习目标: Learning Objectives	<p>练习编码和调试技能，为以后的评估中开发软件分析工具做必要的准备。</p> <p>To practice coding and debugging skills and make necessary preparations for developing a software analysis tool in later assessments.</p>		
德育目标 Moral Objectives	2-1 2-2		
重点: Key Points	编码和调试技能 coding and debugging skills		
难点: Focal points	建立开发环境 Establish development environment		

知识单元序号: Knowledge Unit No.	2	支撑教学目标: SLOs Supported	1-1 1-2
知识单元名称 Unit Title	编译器基础知识应用于源代码分析 apply compiler fundamentals for source code analysis		
知识点: Knowledge Delivery	<p>这个评估任务要求学生开始开源开发的第一次迭代。学生们将在开源工具实现中学习并应用他们的系统编程技能。这是一项单独评估的任务。要求学生提交他们为输出预期结果而开发的文档和代码实现。</p> <p>This assessment task requires the student to start the first iteration of open-source development. The students will learn and apply their system programming skills in open-source tool implementation. This is an individually assessed task. Students are required to submit well-documented code implementation they have developed to output the desired results.</p>		

学习目标: Learning Objectives	了解开源开发方法，并将编译器基础知识应用于源代码分析 To understand open-source development methodology and to apply compiler fundamentals for source code analysis
德育目标 Moral Objectives	2-1 2-2
重点: Key Points	将编译器基础知识应用于源代码分析 to apply compiler fundamentals for source code analysis
难点: Focal points	编译器基础知识 compiler fundamentals

知识单元序号: Knowledge Unit No.	3	支撑教学目标: SLOs Supported	1-1 1-2
知识单元名称 Unit Title	将现有的源代码分析技术应用到实践中 apply the existing of source code analysis techniques into practice		
知识点: Knowledge Delivery	<p>开源开发的第二次迭代。学生将学习将现有的源代码分析技术应用到实践中。我们还鼓励学生进行同行评议和代码评议，以向同行学习。学生需要将他们的学习和专业实践经验联系起来，以展示他们对源代码分析的理解，为下一次评估中设计和实现自动化工具做准备。</p> <p>This assessment task requires the student to start the second iteration of open-source development. Students will learn to apply the existing of source code analysis techniques into practice. The students are also encouraged to conduct peer review and code reviews to learn from their peers. Students will need to connect their learning and professional practice experience to demonstrate their understanding of source code analysis, as a preparation for designing and implementing automated tools in the next assessment.</p>		
学习目标: Learning Objectives	根据需求验证开发的软件分析工具的质量和正确性。 To validate the quality and correctness of the developed software analysis tool based on the requirements.		
德育目标 Moral Objectives	2-1 2-2		
重点: Key Points	源代码分析 source code analysis		
难点: Focal points	软件分析的质量和正确性 To validate the quality and correctness of the developed software analysis tool.		

知识单元序号: Knowledge Unit No.	4	支撑教学目标: SLOs Supported	1-2 1-3 1-5
知识单元名称 Unit Title	信息流分析 Information Flow Tracking		

知识点: Knowledge Delivery	污点分析：是从一个角度对控制和数据依赖性进行推理源（语句/节点）到接收器（语句/节点）。 信息流跟踪分析。 静态污染分析：编译时的污染跟踪。 Taint analysis aims to reason about the control and data dependence from a source (statement/node) to a sink (statement/node). Taint analysis can also be seen as information flow tracking analysis. Static taint analysis: taint tracking at compile time
学习目标: Learning Objectives	完成开源软件分析工具和用户手册 Prepare open-source software analysis tool and user manual.
德育目标 Moral Objectives	2-1 2-2
重点: Key Points	静态污染分析 Static taint analysis
难点: Focal points	信息流跟踪分析 information flow tracking analysis.

四、教学安排 Teaching Schedule

注：可根据实际情况增减行数

Note: Please add/reduce lines based on subject.

教学内容 Teaching Content	学时(周) Hour(Week)			
	理论 LECT.	实验 EXP.	课外实践 PBL	集中实践 PRAC.
软件工程综合实践 1B 介绍 软件分析介绍 Introduction to Software Engineering Studio 1B Introduction to Software Analysis	4			
C++程序设计介绍 Introduction to C++ Programming	8			
作业 1 小测验#1 作业 1 测验#2 作业-1 编码任务：C++编程实践与图形算法 作业讨论 Assignment-1 Quiz #1 Assignment-1 Quiz #2 Assignment-1 Coding Task : C++ Programming Practice and Graph Algorithm Assignment Discussion	4			
LLVM 编译器及其中间表示	8			

代码的图形表示 代码图 LLVM Compiler and Its Intermediate Representation Graph Representations of Code Code Graph				
控制依赖 Control-Dependence	4			
作业 2 测验#1 作业 2 测验#2 作业 2 编码任务：软件分析第 1 部分——控制依赖性 Assignment-2 Quiz #1 Assignment-2 Quiz #2 Assignment-2 Coding Task : Software Analysis Part 1 -- Control Dependence	4			
数据依赖 作业 3 小测验 作业 3 编码任务：软件分析第 2 部分——数据依赖 Data-Dependence Assignment-3 Quiz Assignment-3 Coding Task: Software Analysis Part 2 -- Data Dependence	4			
信息流 Information Flow Tracking	8			
作业 4 小测验 作业 4 编码任务：软件分析第 3 部分——污染信息流跟踪 奖励项目 Assignment-4 Quiz Assignment-4 Coding Task: Software Analysis Part 3 -- Taint Information Flow Tracking Bonus Project	4			
总计 Total	48			

五、教学方法 Teaching Methodology

注：可根据实际情况增减行数或修改内容

Note: Please add/reduce lines or revise content based on subject.

勾选 Check	教学方法与特色 Teaching Methodology & Characters
<input checked="" type="checkbox"/>	多媒体教学：基于信息化设备的课堂教学 Multi-media-basedlecturing

<input checked="" type="checkbox"/>	实践能力传授：理论与行业、实际案例相结合 Combining theory with industrial practical problems
<input checked="" type="checkbox"/>	课程思政建设：知识讲授与德育相结合 Knowledge delivery with ethical education
<input checked="" type="checkbox"/>	PBL 教学：问题驱动的分组学习与交流 Problem-based learning
<input type="checkbox"/>	其他:单击或点击此处输入文字。 Other:单击或点击此处输入文字。

六、成绩评定 Assessment

注：可根据实际情况增减行数或修改内容

Note: Please add/reduce lines or revise content based on subject.

考核环节: Assessment Content	平时 Behavior	环节负责人: Director	程绍辉张旭 S. Cheng X. Zhang
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	30
考核方式: Measures	记录学生平时的课堂表现和考勤，缺勤不得分。 Record students' class performance and attendance. No score will be given for absence.		

考核环节: Assessment Content	期中 Mid-term	环节负责人: Director	Yulei Sui
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	32
考核方式: Measures	以 CC Canvas 学生小测验评定。 Results will be evaluated by CC Canvas student quizzes.		

考核环节: Assessment Content	期末 Final	环节负责人: Director	Yulei Sui
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	38
考核方式: Measures	以 CC Canvas 学生作业 coding 评定。 Results will be evaluated by CC Canvas student Assignments Coding.		

考核环节: Assessment Content	Bonus	环节负责人: Director	Yulei Sui
给分形式: Result Type	百分制 Marks	课程总成绩比重(%): Percentage (%)	分到中期末 divide into Mid-Term and Final
考核方式: Measures	Bonus 可以选做。以 CC Canvas 学生 bonus coding 评定。 Results will be evaluated by CC Canvas student bonus Coding.		

七、改进机制 Improvement Mechanism

注：未尽事宜以教学团队以及学院教学指导委员会商定为准。

Note: Matters not covered in this file shall be determined by TAB of SSTC, NEU.

教学大纲改进机制 Subject Syllabus Improvement Mechanism			
考核周期(年): Check Period (YR)	4	修订周期(年): Revise Period (YR)	4
改进措施: Measures	课程负责人根据课程教学内容与人才培养目标组织课程团队讨论并修改教学大纲，报分管教学工作副院长审核后由执行院长批准。 The subject coordinator shall be responsible for the syllabus discussion and improvement, and the revised version shall be submitted to deputy dean (teaching affairs) for reviewing then to executive dean for approval.		
成绩评定改进机制 Assessment Improvement Mechanism			
考核周期(年): Check Period (YR)	1	修订周期(年): Revise Period (YR)	1
改进措施: Measures	课程负责人根据课程教学内容、课堂教学效果以及成绩分布，对课程教学方法和成绩评定环节进行改进，并同步优化评定办法。 The subject coordinator shall revise the syllabus based on the teaching content, effect and result distribution while optimize the assessment measures.		