

Faculty-Led Education Abroad Proposal

Computer Science Across Cultures: Collaborative Algorithm Problem Solving

Learning Outcomes

1. Demonstrate all the learning outcomes listed in the course specifications for the technical course being taught (CSCE 310H) on our campus;
2. Gain a better understanding of Omani culture and history;
3. Use this academic and cross-cultural experience as an opportunity to be increasingly introspective and knowledgeable about the USA, its role and impact domestically and globally on science technology transfer;
4. Develop close relationships with our Omani hosts and academic partners;
5. Exhibit confidence in dealing with new and unfamiliar places and situations;
6. Return home with an expanded ability to engage transnationally with citizens from other cultures and linguistic backgrounds to achieve commonly identified scientific projects.

Program Overview

This program, based in one location (Muscat, the capital of Oman), will be the product of a close collaboration with Sultan Qaboos University and educational consultant Inspire Oman. The program will include a sophomore or junior level 3 credit hour UNL computing course, CSCE 310H, to be taken alongside local Omani students, as well as a 1 credit hour regionally focused course taught by an instructor from SQU. Students will also have a wide range of cultural immersion activities that will include the participation of Omani students.

Oman, located on the southeast coast of the Arabian Peninsula, is a strategically important country in the Middle East. Compared to its neighbors United Arab Emirates (UAE) and Saudi Arabia, Oman has modest oil reserves and is not a resource-rich country. Per the Drum Cussac Security Profile, “Oman is ruled by the Sultan of Oman, a hereditary autocratic monarch who faces little credible challenge to stability and whose family has ruled the country since 1741. ... The economy is relatively stable and dominated by the production of oil, though mineral resources also exist. The population enjoys a relatively high standard of living by regional standards and levels of corruption are extremely low as compared with much of the world.”

Located on the northern coastline, Muscat is the capital of the Sultanate of Oman and the country's primary seaport and commercial center, with just over one million people in a metropolitan area of approximately 1,351 square miles. Per the Drum Cussac Security Profile, “Muscat is considered one of the most forward-thinking cities in the region... it was literally walled off from the outside world with locked gates until 1970, when it experienced a reawakening under the progressive rule of Sultan Qaboos bin Said. Muscat has been rapidly developing since, with modern infrastructure, a vibrant economy and a multi-ethnic society, with foreign expatriates accounting for 40% of its population. Today the capital maintains a fine balance between welcoming modernity and preserving cultural tradition, and enjoys unwavering stability in an otherwise turbulent region. Arabic is the official language and Islam the predominant religion, although many people speak English proficiently and other religions are accommodated, with a number of churches and Hindu temples present in the city.”

There is strong history of engineers working in the Middle East in various industries, and UNL has recently had a number of Omani students in its Computer Science and Engineering programs. There are currently no other UNL faculty-led programs designed for Computer Science and Engineering students. While there is a tourism/development program in Oman and the UAE over Spring Break 2018, the themes and target audiences are very different and therefore will not compete for participants.

Leader Biography

Dr. Charles (Chuck) Riedesel, Assistant Professor of Practice in Computer Science & Engineering, will serve as the primary faculty leader. Dr. Riedesel has served as Chief Undergraduate Advisor for Computer Science & Engineering for 22 years. He has taught 20+ different courses at UNL, advised student organizations, and led multiple teams to the ICPC World Finals programming contests. He is presently the Regional Contest Director for the ICPC. Given that he works one-on-one with students in an advising role, he has addressed many personal student crises and is confident in supporting students on a more personal level abroad. He uses many innovative teaching methods, particularly in his CSCE 310H course, emphasizing learning through hard work (both independently and through teamwork), forcing students to “think outside the box” and engage in true problem solving. In addition to Dr. Riedesel’s teaching and advising qualifications, he has previously visited Morocco, Jordan, Israel, and Turkey and is comfortable traveling to the Middle East.

Dr. Ryan Patrick, a lecturer in the Computer Science department, will serve as the secondary faculty leader. Dr. Patrick, who began teaching at UNL in Fall 2013, regularly teaches the non-honors CSCE 310 course, along with Computer Science I and Programming Language Concepts. He is a judge, and a manager of student judges for the ACM ICPC Programming Contest. He received the departmental Student Choice Outstanding Teaching Award Upper Level (300-400) for academic year 2014-2015. Dr. Patrick has some training in Arabic.

The participation of both Dr. Patrick and Dr. Riedesel will promote long-term sustainability for the program. UNL received a “Capacity Building Grant for U.S. Undergraduate Study Abroad,” which will cover travel costs for four travelers (flights, hotel, meals, ground transport, and visas for one week) to develop the program. At least one leader will be funded to visit Oman prior to the Summer 2018 program.

Academic and Cultural Experiences

Dr. Riedesel’s CSCE 310H is a mid-level algorithms course based on competitive, collaborative programming in a small group setting. This pedagogical approach builds off of the professional Association for Computing Machinery’s International Collegiate Programming Contest (ACM-ICPC), for which Dr. Riedesel serves as a regional director. ACM-ICPC is a multi-tier, team-based, programming competition that involves a global network of universities who host regional competitions with winners advancing to the ACM-ICPC World Finals. Participation in these competitions has grown to include students and faculty in computing disciplines from more than 2,700 universities in 102 countries on six continents. Dr. Mohammed Al-Badawi, Assistant

Professor in the Department of Computer Science at Sultan Qaboos University, has coached a team in the competition. Students will complete the requisite 45 contact hours (37.5 clock hours), plus 15-20 hours of (5-hour) computing contests and assignments outside the classroom.

If possible, Dr. Al-Badawi will co-teach the CSCE 310H course for SQU students, who already take a portion of their coursework in English, thereby alleviating language barriers. Alternatively, Dr. Al-Badawi will invite his students to participate in the contests, ideally with a ratio of 2 UNL students to every Omani student. Contest teams consist of 3 members who must communicate closely in order to pool their skills and coordinate the use of a single computer. This close interaction with Omani peers will be the cornerstone of the program.

In addition to the Computer Science course, the program will incorporate a regionally-focused, locally-taught course in the history and culture of the Middle East. This culture-specific course will increase the program offering to 4 credit hours, the addition of which will help students gain a deeper understanding of the region. Students will complete the requisite 15 contact hours (12.5 clock hours) in addition to assignments and experiences outside the classroom.

The students will contextualize their learning through cultural excursions and guided tours around Muscat as well as sites such as Nizwa Fort. Based on cost estimates, the group may also take an excursion to the United Arab Emirates, to visit the “Silicon Valley” of the UAE and the sustainable “futuristic” Masdar City in Abu Dhabi, as a point of comparison with Oman.

(This paragraph and the next are adapted from a letter by Zainab Jones – see next section.) The field trips would all be related to culture and history. For example, the Grand Mosque has a long walkway filled with the different periods of Islamic art with explanations of each period. Our field trips are accompanied either by Zainab or a guide/guest speaker who is knowledgeable of the site. These trips can be developed into light assignment-based learning experiences for the students. Of course these may only serve to expose students to Omani history and culture. This can be supplemented by other lectures delivered by professionals/professors in the fields of regional history. When Inspire Oman runs a program like this, students are usually required to journal and have regular debriefing sessions with their lead faculty and/or Zainab. The advantages of this would be a lighter, more experiential based learning model that allows students to reflect on their experiences and encourages them to analyze them on a regular basis. It also gives lecturers the ability to openly speak on topics that may otherwise be a little sensitive such as tribalism, the monarchies, etc.

An option is to have one of the history professors at SQU develop a short summer syllabus, then employ an SQU professor on a contract basis to develop and deliver the off campus course.

Logistical Arrangements

Inspire Oman, led by Zainab Jones, will serve as the primary on-site partner for logistical administration and student support, providing orientation, lodging, transportation, and cultural excursions. Inspire Oman carries liability insurance, will work to mitigate potential risks, and will respond to student emergencies. UNL’s Education Abroad Office will work with Travel and Transport to arrange a roundtrip group flight from Lincoln or Omaha to Muscat. Inspire Oman

will arrange airport transfers for the group. Students and leaders will be housed in rented houses/apartments with air conditioning and Wi-Fi within a 10-minute city bus ride to SQU. Students will purchase most meals on their own, either on campus or near their houses/apartments, but Inspire Oman will arrange some group meals. SQU will identify classroom and computer lab space for the courses. U.S. citizens will need either tourist visas or student visas; UNL will verify with SQU which type is most appropriate. Tourist visas can be obtained on arrival at the Muscat airport. The CDC recommends Hepatitis A and Typhoid vaccines for “most travelers.”

Student Qualifications

The target audience is honors-capable sophomore or junior undergraduate students majoring or minoring in Computer Science or Computer Engineering, including Raikes participants. While students from other institutions may apply, preference will be given to UNL students. Prerequisites are CSCE 156 and CSCE 235, or RAIK 184H. Honors-capable is understood to mean 3.000+ GPA and grades of B or above in the prerequisites. Most incoming fall 2017 freshmen will have the prerequisite courses completed in time for the summer 2018 experience.

Student Enrollment/Recruitment

In the summer of 2018, the program will need a minimum of 10 students to participate, with a maximum enrollment of 15 students. Throughout the Fall 2017 semester, Dr. Riedesel will recruit the first group of student participants. Dr. Riedesel will take primary responsibility for recruiting students through classroom presentations, informational sessions, and attending all relevant education abroad fairs. The Education Abroad Office and the Office of Global Strategies will create videos promoting Oman, UNL, and the cultural and academic exchange of students, faculty, and staff in recent years. Lark Bear will support Dr. Riedesel’s marketing efforts by inviting the EAO staff to present in classes, frequently sending email announcements to eligible students, displaying paper brochures in the advising center, and posting digital signs in high-traffic areas. Several Omani engineering students have been identified who may assist in promotions of their home country. Stephen Cooper is prepared to support recruitment of his Raikes students. Ann Koopmann is ready for promotion with her CSCE 10 students who include nearly all new fall freshmen, the primary target audience.

Student Preparation

The group will have a minimum of three preparatory meetings to review academic expectations, program itinerary, and health and safety measures. Current UNL undergraduate and graduate students from Oman will be invited to present to the participants on Omani food, culture, and basic Omani Arabic phrases. Zainab from Inspire Oman will join at least one group meeting by video conference, to provide reassurance and answer students’ questions about the itinerary, accommodations, packing suggestions, etc.

Evaluation/Assessment and Reentry Programming

The Education Abroad Office will identify individuals trained in the Intercultural Development Inventory (IDI) to administer a pre-test to all participating students. Following their return to campus, all UNL students will take a post-test assessment to measure change specific to the IDI. The IDI will help us identify when and where students are experiencing personal and professional success and development, beyond the time they spend in the classroom.

While in Oman, Inspire Oman's Zainab Jones and the faculty leaders will lead group discussions for reflection and processing. Upon return, the EAO staff and faculty leaders will host a dinner reunion and hold a debriefing "focus group" session for students, to allow for group conversation and reflection.

Health, Safety, and Accessibility

Per the Drum Cussac Security Profile, "There are few serious security threats posed to foreign travelers and the main hazards are road traffic accidents and seasonal climatic extremes, including cyclones and extreme heat. Infrastructure is well developed in urban areas but may be lacking in many rural areas though Oman has made great strides forward in overall infrastructure development over the last two decades." Medical care outside of main urban areas can be less adequate, though conditions vary from facility to facility. Sanitation is often adequate, but students will be encouraged to drink bottled water and closely monitor food quality. Oman is vulnerable to cyclones between April and December, but May and November are the highest risk months. Summer winds often raise large sandstorms and dust storms in the interior, but Muscat is located on the coast.

Some local laws, as well as Omani cultural norms, differ significantly from the US. For example:

- Drinking alcohol is only permitted in hotels, bars, homes, and some restaurants.
- Using vulgar language or hand gestures can lead to personal defamation charges.
- Students will need to be sensitive to Islamic culture and not wear sleeveless shirts, halter-tops, or shorts.
- Consensual same-sex sexual conduct is illegal and subject to a jail term of six months to three years.

In regard to physical accessibility:

- Public transportation is generally inaccessible.
- Most medical facilities and public buildings in cities have wheelchair ramps and elevators. Outside of urban areas, access is greatly reduced.
- Omanis will generally try to accommodate reasonable requests for assistance.

Zainab Jones from Inspire Oman will give the students an extensive pre-departure orientation, pre-departure checklist and packing guide, and on-site orientation to address these and other specific concerns.

Attachments

Preliminary Budget – See Separate Document

Schedule & Itinerary

	Sunday	Monday	Tuesday	Wednes- day	Thursday	Friday	Saturday
Week 1	(Arrive late Saturday night) Orientation City tour Welcome dinner	Courses (3 hours total) Cultural activities and/or free time	Courses (3 hours total) Cultural activities and/or free time	Courses (3 hours total) Cultural activities and/or free time	Courses (3 hours total) Cultural activities and/or free time	Cultural activities in Muscat; free time	Cultural activities in Muscat; free time
Week 2	Courses (3 hours total) Computing contest (5 hours)	Courses (3 hours total) Cultural activities and/or free time	Courses (3 hours total) Cultural activities and/or free time	Courses (3 hours total) Cultural activities and/or free time	Courses (3 hours total) Cultural activities and/or free time	Excursion: Dolphin watching; hiking, swimming, biking; drumming	Excursion: Cattle market; Nizwa Fort; traditional village meal
Week 3	Courses (3 hours total) Computing contest (5 hours)	Courses (3 hours total) Cultural activities and/or free time	Courses (3 hours total) Cultural activities and/or free time	Courses (3 hours total) Cultural activities and/or free time	Courses (3 hours total) Cultural activities and/or free time	Cultural activities in Muscat; free time	Cultural activities in Muscat; free time
Week 4	Courses (3 hours total) Computing contest (5 hours)	Courses (3 hours total) Cultural activities and/or free time	Courses (3 hours total) Cultural activities and/or free time	Courses (3 hours total) Cultural activities and/or free time	Courses (3 hours total) Cultural activities and/or free time	Excursion: Dubai, UAE	Excursion: Abu Dhabi, UAE
Week 5	Excursion: Dubai, UAE	Depart from Dubai for US					

Notes:

- The program dates will roughly align with the Second Five Week Session at UNL
- Weekends in Oman are Friday-Saturday

Syllabus (Fall 2017 example)

CSCE310H - Data Structures and Algorithms

Course Concept:

This is an honors section of CSCE 310 being offered Fall semester 2017, MWF from 2:30PM-3:20PM in Burnett 124 by Prof. Charles Riedesel. By the end of the course students will have covered basically the same material as in the regular section (see course specifications below) but in greater depth, and with an orientation and pedagogy related to programming contests, ala ACM's ICPC.

At least some sections of all chapters in the Levitin text (3rd ed.) will be covered. Appendix B on analysis techniques and certain other sections may be covered only very briefly, with the expectation that honors students will already be familiar with the topics.

Student Requirements:

By default the following 6 components each contribute roughly the same weight to the final grade. Be aware that grades will not be based on accumulating points. In contrast to standard courses, it is expected that all students should be capable of doing excellent work, so that A's and perhaps a few B's should be the norm. Most feedback will be through comments and suggestions for improving performance, both written (as in the case of homework exercises) and oral (as for contests). The goal of this course is learning, not grades. The measure of this is primarily in how much you can impress yourself, the TAs, and instructor.

1. **Contest Problem-Set** – This is a semester-long team project in which exercises will be created and cast as programming contest problems, complete with description, sample input and output, judges input and output, and sample solutions in both C/C++ and Java. The exercises will exemplify specified algorithms or algorithmic design strategies as covered in the chapters of the text. The intent is that the problem-set will be produced progressively over the semester with opportunities to resubmit earlier problems until perfected.
2. **Homework** – These are classic textbook exercises and “puzzlers”. A host of exercises in several categories will be listed with the expectation that students (and in some cases teams) will work at solving a significant subset of them. There will be too many for any one person to solve, and there is no expectation that anyone should attempt this! Quality, not quantity, is the objective. The more you can think through the challenging ones with a minimum of collaboration, the better. Exercises will be announced early in the course. Deadlines are mostly up to each student to set and meet. Having the self-discipline to manage a good work pace has been one of the most challenging aspects of this course.
3. **Cheat Sheet** – This work-in-progress will be based on group production of a 25 page PDF collection of notes, examples, etc. plus coded classes or functions and structs (depending on the language choice) of advanced data structures and algorithms, suitable as a contest “cheat sheet” designed for quick entry and easy adaptation in programming contests. These should be updated and resubmitted following each of the monthly contests.
4. **Participation** – Participation including attendance, assistance with local and regionals contests, and other involvements contributing to the advancement of competitive programming both inside and outside of the classroom. Credit can be earned through class presentations. A schedule will be set for teams to present from a selection of topics

throughout the semester. Presentation details must be reviewed with the instructor prior to class.

5. **Contests** – Rather than having traditional exams, credit will come from participation in monthly (five) full 5-hour contests in lieu of midterms and final exam. Grading is a composite of observations during the contest, final scores, and debriefings. Conditions for the contests may vary. Some may reuse past regional contests; one could include exercises from the team generated contests (see item #1); allowed material is typically only the cheat sheet from item #3 above.
6. **Portfolio** –The final submission for the semester will be a portfolio of whatever work each student feels is his/her best. This may include components from any of the above categories. With team products, it will be expected that the student's contribution is identified.

CSCE 310 Catalog Description:

Theoretical concepts with programming assignments. A review of algorithm analysis, asymptotic notation, and solving recurrence relations. Advanced data structures and their associated algorithms, heaps, priority queues, hash tables, trees, binary search trees, and graphs. Algorithmic techniques, divide and conquer, transform and conquer, space-time trade-offs, greedy algorithms, dynamic programming, randomization, and distributed algorithms. Introduction to computability and NP-completeness.

Relationship of Course to Program Requirements:

Required for Computer Science and Computer Engineering programs.

Textbook(s) and/or Other Required Materials:

1. Anany Levitin, *The Design and Analysis of Algorithms*, supplemented as necessary with handouts.

Prerequisites by Topic:

1. Mastery of data structures and operations for lists, stacks, queues, trees, graphs. Abstract data types. Discrete mathematics topics including induction and recursion, set theory, elementary combinatorics, elementary graph theory.
2. Familiarity with recursive algorithms and recurrence relations.

Course Objectives:

1. Mastery of algorithmic approaches including greedy method and divide-and-conquer. A variety of common algorithms for searching and sorting, hashing, heaps; DFS, BFS, and other elementary algorithms on trees and graphs.
2. Familiarity with problems on graphs and advanced graph algorithms; algorithm correctness.
3. Exposure to dynamic programming, NP Completeness, decidability.
4. Exposure to issues involved in advanced algorithm techniques such as distributed computing, parallel algorithms, or randomized algorithms.

Topics Covered:

It is expected that specific algorithms, problem solving techniques, and complexity analysis will be taught as textbook topics and strongly reinforced with substantial theoretical and programming assignments, including theoretical and empirical analyses of complexity. "Mastery" implies ability to apply the knowledge gained in innovative and novel ways. This

requires practice.

1. Review of algorithm analysis and asymptotic notation, solving summations and recurrences.
2. Advanced data structures and associated algorithms
 - a. Heaps and applications (priority queues, heapsort)
 - b. Hash Tables: advanced hashing techniques, collision resolution, rehashing and applications
 - c. Advanced tree data structures: binary search trees and balanced search tree such as AVL and 2-3 Trees
 - d. Graph representations and algorithms: DFS, BFS, and applications: topological sort, strongly connected components, spanning trees, shortest-path, etc.
3. Algorithmic techniques
 - a. Brute force algorithms for string matching, closest pair of points, etc.
 - b. Decrease-and-conquer algorithms: binary search, fake-coin problem, etc.
 - c. Divide-and-conquer algorithms for closest pair of points, convex hull, matrix multiplication, etc.
 - d. Space and time trade-offs: input enhancement in string matching, hashing, etc.
 - e. Dynamic programming: optimal substructure property, shortest paths algorithms, 0-1 knapsack problem, etc.
 - f. Greedy algorithms: greedy choice and optimal substructure properties, e.g. fractional knapsack, Huffman codes, MST.
4. Introduction to NP-Completeness, and decidability.

Relationship of Course to Program Objectives:

Contributes to Computer Engineering Program Objectives 1, 2, 3, 4 and Student Outcomes 2.a, 3.a, and 3.b, and contributes to Computer Science Program Objectives 1, 3 and 4 and Student Outcomes 2.a, 3.a and 3.b.

Class/Laboratory Schedule:

Lecture: 45 hours = 3 hours/week for 15 weeks. Recitation: 15 hours = 1 hour/week for 15 weeks. (*Note: No recitation is included in the honors section. Instead there will be monthly 5-hour-long programming contests at dates and times agreed upon by the class.*)

Online Contest Resources:

http://en.wikipedia.org/wiki/Competitive_programming -
[http://cm.baylor.edu/ICPCWiki/Wiki.jsp?page=Problem Resources](http://cm.baylor.edu/ICPCWiki/Wiki.jsp?page=Problem_Resources)
<http://www.makeuseof.com/tag/8-onlineprogramming-contests-challenge-win/>
<http://uva.onlinejudge.org/>
<http://www.topcoder.com/>
<http://code.google.com/codejam/>
<http://www.codechef.com/>
<http://acm.mipt.ru/judge/problems.pl>
<http://acm.timus.ru/>
<http://enigma.csmiit.org/online-programming-contest/>
<http://campusconnect.infosys.com/Aspirations/StaticPages/AP/ProgrammingContest.aspx>
<http://www.techgig.com/codecontest>
<http://www.codeforces.com/>
<http://projecteuler.net/problems>

http://www.ieee.org/membership_services/membership/students/competitions/xtreme/index.html
<http://www.spoj.com/>
<https://www.interviewstreet.com/challenges/>

Online Language Resources & IDES:

(Note: By default code created in Visual Studio WILL NOT COMPILE on the CSE server. This is because it includes Microsoft proprietary libraries. Removing “ #include “stdafx.h” ” will allow it to compile so long as everything else is correctly included and not Microsoft proprietary)

<http://www.cplusplus.com/>
<http://docs.oracle.com/javase/8/docs/api/index.html>
<https://www.tutorialspoint.com/java/>
<https://www.tutorialspoint.com/cplusplus/>
<https://stackoverflow.com/>
<http://www.eclipse.org/downloads/eclipse-packages/>
<https://www.visualstudio.com/downloads/>

Accommodations for Students with Disabilities:

Students with disabilities are encouraged to contact **the instructor** for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodations to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.

Suggestion Box Details:

The CSE Department has [an anonymous suggestion box](#) that you may use to voice your concerns about any problems in the course or department if you do not wish to be identified.

Check Email!

It is CSE Department policy that all students in CSE courses are expected to regularly check their email so they do not miss important announcements.

Academic Integrity:

The standard for CSE students is this: All homework assignments, quizzes, exams, etc. must be your own work. No direct collaboration with fellow students, past or current, is allowed unless otherwise stated (which will be allowed in most instances in this course!). The Computer Science & Engineering department has an [Academic Integrity Policy](#). All students enrolled in any computer science course are bound by this policy. You are expected to read, understand, and follow this policy. Violations will be dealt with on a case-by-case basis and may result in a failing assignment or a failing grade for the course itself.

The Contest Problem Set, Cheat Sheet, and Contests are all team based, with grades apportioned according to individual evaluations of the team activity. Contributions between teams should be documented. Standard homework exercises are to be attempted individually, and if stumped,

then reach out to the team. Care should be taken to document whether these are individual or team completed. It is imperative that the team based solutions are understood and can be explained by each member.