

**Utah System of Higher Education
New Academic Program Proposal
Cover/Signature Page - Abbreviated Template**

Institution Submitting Request: The University of Utah
Proposed Program Title: Undergraduate Certificate in Computational Linguistics
Sponsoring School, College, or Division: College of Humanities
Sponsoring Academic Department(s) or Unit(s): Department of Linguistics
Classification of Instructional Program Code¹ : 16
Min/Max Credit Hours Required of Full Program: 20 / 27
Proposed Beginning Term²: Fall 2020
Institutional Board of Trustees' Approval Date:

Program Type:

<input type="checkbox"/>	Certificate of Proficiency	<input type="checkbox"/>	Entry-level CTE CP	<input type="checkbox"/>	Mid-level CP
<input checked="" type="checkbox"/>	Certificate of Completion				
<input type="checkbox"/>	Minor				
<input type="checkbox"/>	Graduate Certificate				
<input type="checkbox"/>	K-12 Endorsement Program				
<input type="checkbox"/>	NEW Emphasis for Regent-Approved Program <i>Credit Hours for NEW Emphasis Only:</i> Min Cr Hr / Max Cr Hr <i>Current Major CIP:</i> 6 - Digit CIP <i>Current Program Title:</i> <i>Current Program BOR Approval Date:</i>				
<input type="checkbox"/>	Out of Service Area Delivery Program				

Chief Academic Officer (or Designee) Signature:

I, the Chief Academic Officer or Designee, certify that all required institutional approvals have been obtained prior to submitting this request to the Office of the Commissioner.

_____ Date:

☐ I understand that checking this box constitutes my legal signature.

¹ For CIP code classifications, please see <http://nces.ed.gov/ipeds/cipcode/Default.aspx?y=55>.

² "Proposed Beginning Term" refers to first term after Regent approval that students may declare this program.

**Utah System of Higher Education
Program Description - Abbreviated Template**

Section I: The Request

The University of Utah requests approval to offer the following Certificate of Completion: Undergraduate Certificate in Computational Linguistics effective Fall 2020. This program was approved by the institutional Board of Trustees on .

Section II: Program Proposal/Needs Assessment

Program Description/Rationale

Present a brief program description. Describe the institutional procedures used to arrive at a decision to offer the program. Briefly indicate why such a program should be initiated. State how the institution and the USHE benefit by offering the proposed program. Provide evidence of student interest and demand that supports potential program enrollment.

This undergraduate certificate is designed to help students acquire the knowledge and skills necessary to pursue a career path in an area of technology known alternatively as Computational Linguistics and Natural Language Processing (NLP). This is the science behind machine translation, text-to-speech, speech recognition, and many other important applications. The Department of Linguistics arrived at the decision to offer this program through discussions between the Department of Linguistics and the School of Computing involving faculty members, administrators, and undergraduate advisors. After the two departments agreed on the curricular content of the program, this curricular plan was presented to and voted on by the 11 tenure-line faculty of the Department of Linguistics (the host department). The result of the vote was 8 in favor, 0 opposed, and 3 abstaining.

The program will be beneficial to students pursuing a career in technology. Leaders of technology companies (Cliff Miller, CEO of TrueLake; David L. Bean, founder of Attensity) have told the Department of Linguistics that the technology industry is increasingly looking for people with a strong linguistics background to complement their computing abilities. Some graduates of the Department of Linguistics and School of Computing have already gotten jobs with major technology companies such as Amazon to help with the development of their language-related technologies (e.g., Alexa). The ability of University of Utah students to get such jobs in the future will be even greater if they are able to earn a structured certificate in computational linguistics.

The University of Utah and the USHE will benefit from the program by its potential to attract new students to the university and its ability to place them in well-paying jobs after graduation.

One indicator of student interest and demand is the number of undergraduate students most recently enrolled in LING 3300 Computers and Language (11 students) and CS 5340 Natural Language Processing (19 students). Another indicator is the fact that 15 high school students from Utah came to The University of Utah in January, 2019 to participate in the North American Computational Linguistics Olympiad. This is an annual event whose numbers are strong each year. Additionally, the Department of Linguistics regularly receives questions from undergraduate students about opportunities to study computational linguistics and earn credentials in this area. Student interest in computational linguistics is strong among linguistics majors, and this led the undergraduate student association called the Linguistics Club of The University of Utah (or LCU) to invite Dr. Ellen Riloff from the School of Computing to speak to them last year about her work on Natural Language Processing.

Labor Market Demand

Provide local, state, and/or national labor market data that speak to the need for this program. Occupational demand, wage, and number of annual openings information may be found at sources such as Utah DWS Occupation Information Data Viewer (jobs.utah.gov/jsp/wi/utalmis/gotoOccinfo.do) and the Occupation Outlook Handbook (www.bls.gov/oco).

An article in the Wall Street Journal on November 1, 2018 reported that "the University of California, Berkeley, is creating a division devoted to data science at a time when Silicon Valley can't hire enough specialists." Importantly, data scientists are people with combined training in both programming and other specializations, such as linguistics. Glassdoor.com currently lists

347 job openings in computational linguistics in the United States, at technology companies (e.g., Google, Apple, Amazon), service corporations (e.g., Lionbridge, USAA,), academia (e.g., University of Illinois), and government contractors (e.g., defense and intelligence contractors). Annual salaries for computational linguists range from \$65,000 to \$120,000, with a national average of \$91,307. These positions are embedded within the larger employment categories of

(1) software developers, with a 2016-2026 Utah occupational projection of 1,550 new positions, and a nationwide outlook of 19% growth in the same period of time;

(2) computer programmers, with a 2016-2026 Utah occupational projection of 380 new positions, and a nationwide outlook of a 7% decline; and

(3) computer and information research scientists, with a 2016-2026 Utah occupational projection of 50 new positions, and a nationwide outlook of 19% growth during that same period of time.

Consistency with Institutional Mission/Impact on Other USHE Institutions

Explain how the program is consistent with the institution's Regents-approved mission, roles, and goals. Institutional mission and roles may be found at higheredutah.org/policies/policyr312/. Indicate if the program will be delivered outside of designated service area; provide justification. Service areas are defined in higheredutah.org/policies/policyr315/.

The new certificate in computational linguistics will contribute to The University of Utah's mission to "generate and share new knowledge, discoveries, and innovations." It will provide students with a depth of knowledge related to (a) the perceivable and measurable properties of language, (b) the way these properties are structured and how they interact with one another, (c) ways of modeling this information theoretically as well as computationally, and (d) how to test hypotheses, solve problems, and create useful applications involving human language with the use of advanced computational methods.

From the perspective of The University of Utah strategic goals, the new certificate program will "build program quality in key areas" by enhancing the level of specialized training offered in both linguistics and computer science. It will also "increase participation in high impact programs" by offering a new, high-impact program for which there is already a good deal of student interest and market demand.

The program will be offered at The University of Utah within the designated service area.

Finances

What costs or savings are anticipated in implementing the proposed program? If new funds are required, indicate expected sources of funds. Describe any budgetary impact on other programs or units within the institution.

Most of the costs of implementing the proposed program will be absorbed by things our department is already paying for, such as personnel and website access. These costs include advertising the program on our departmental website (approximately 10 hours per year, or .5% of our executive secretary's annual salary), meetings between interested students and our undergraduate advisor (approximately 10 hours per semester, or 1% of our undergraduate advisor's annual salary), meetings between the certificate oversight committees from the Department of Linguistics and the School of Computing (approximately 2 hours per year, or .16% of the annual salaries of 4-6 faculty members), course scheduling (approximately 4 hours per year, or .3% of the annual salaries of two faculty members and .4% of the annual salaries of the part-time staff members who manage the scheduling). Additionally, we will need to offer our two computational linguistics courses (LING 3300 and 5300) each year, which involve costs equivalent to one-half of a tenure-line faculty member's teaching load (or approximately 20% of the faculty member's salary). The Dean of the College of Humanities has approved our request to hire a full-time tenure-line faculty member with a specialty in computational linguistics. The person we hire will begin teaching our computational linguistics courses (and other courses) in Fall Semester, 2020, and will help the department chair oversee and coordinate the certificate program.

The only additional expense will be the printing and distribution of fliers and other promotional materials to advertise the new certificate.

Section III: Curriculum

Program Curriculum

List all courses, including new courses, to be offered in the proposed program by prefix, number, title, and credit hours (or credit equivalences). Indicate new courses with an X in the appropriate columns. The total number of credit hours should reflect the number of credits required to receive the award. **For NEW Emphases, skip to emphases tables below.**

For variable credits, please enter the minimum value in the table below for credit hours. To explain variable credit in detail as well as any additional information, use the narrative box below.

Course Number	NEW Course	Course Title	Credit Hours
General Education Courses (list specific courses if recommended for this program on Degree Map)			
General Education Credit Hour Sub-Total			0
Required Courses			
LING 1200		Intro to the Study of Language (or LING 1069: Bad Words...)	3
CS 1410		Intro to Object-Oriented Programming	3
CS 2420		Intro to Algorithms & Data Structures	3
CS 3100		Models of Computation	3
CS 3500		Software Practice	3
LING 4010		Intro to Phonetics & Phonology (or LING 4020: Intro to Syntax or LING 4030: Intro to Semantics)	3
LING 3300		Computers and Language (or CS 3505: Software Practice II)	3
CS 5340		Natural Language Processing	3
LING 5300		Computational Linguistics	3
Add Another Required Course			
Required Course Credit Hour Sub-Total			27
Elective Courses			
Add Another Elective Course			
Elective Credit Hour Sub-Total			0
Core Curriculum Credit Hour Sub-Total			27

Propose a NEW Emphasis to an existing Regent approved program

Program Curriculum Narrative

Describe any variable credits. You may also include additional curriculum information, as needed.

This certificate requires nine courses (27 credit hours). However, one of the Computer Science courses (CS 1410) has a chain of prerequisites not listed among the required courses for the certificate. These prerequisites include MATH 1050 College Algebra, MATH 1060 Trigonometry, CS 1030 Foundations of Computer Science, and CS 1210 Calculus 1. One of these prerequisites (CS 1030) may nevertheless be waived by passing the screening exam for CS 1410.

CS 3100 has a prerequisite of CS 2100 Discrete Structures, which may be waived by demonstrating knowledge of finite-state machines.

Three of the required Linguistics courses may be substituted with pre-approved alternative courses: LING 1200 may be substituted with LING 1069; LING 4010 may be substituted with LING 4020 or 5030 or 5190; and LING 3300 may be substituted with CS 3505.

It is anticipated that most of the students who enroll in the certificate program will be Computer Science or Linguistics majors. Computer Science majors can earn the certificate by taking as few as three courses--all linguistics courses--outside of their major. Linguistics majors earning the certificate will need to take at least five courses outside of their major, and will need to take more than this if they are not able to pass the screening exams for CS 1410 or CS 3100.

The Degree Map on the following page indicates the order in which the courses in the program are intended to be taken. It also indicates that the certificate can be completed in two years. However, the headings "First Year" and "Second Year" on the Degree Map do not literally refer to students' freshman or sophomore years. Because most students do not declare linguistics as their major until their sophomore or junior year, and because many of our majors transfer to the University of Utah from other institutions, we do not anticipate that students will begin to pursue this certificate until their junior or senior year.

The Department of Linguistics has created several partnerships with other institutions to make sure their students are aware of the new Certificate in Computational Linguistics and to help prepare these students to enter the certificate curriculum with the necessary prerequisites and at an appropriate time--in a way that will allow them to complete the certificate without delaying their graduation. The institutions that have agreed to partner with us in this manner include the Quantitative Analysis of Markets & Organizations (QAMO) program in the David Eccles School of Business, the Department of English at Salt Lake Community College, and several high schools in the region whose students participate in the annual North American Computational Linguistics Olympiad (NACLO) each year. These high schools include the following:

- Academy for Math, Engineering & Science (Murray)
- Highland High School (Salt Lake City)
- Hillcrest High School (Midvale)
- Providence Hall (Herriman)
- Skyline High School (Millcreek)
- West High School (Salt Lake City)

Academic advisors in both departments will be cross-trained in order to be able to advise students on all of the courses and prerequisites they will need for the certificate, how to get into these courses, and when to take them. One faculty member from each department will be assigned to work with the advisors, as needed. The advisors and faculty members from both departments will also meet together once each year in order to coordinate their efforts, remind themselves of the requirements of both departments as they relate to the certificate, and address any problems or concerns that may have arisen.

Degree Map

Degree maps pertain to undergraduate programs ONLY. Provide a degree map for proposed program. Degree Maps were approved by the State Board of Regents on July 17, 2014 as a degree completion measure. Degree maps or graduation plans are a suggested semester-by-semester class schedule that includes prefix, number, title, and semester hours. For more details see <http://higheredutah.org/pdf/agendas/201407/TAB%20A%202014-7-18.pdf> (Item #3).

Please cut-and-paste the degree map or manually enter the degree map in the table below

First Year Fall	Cr. Hr.	First Year Spring	Cr. Hr.
LING 1200 Intro to the Study of Language (or LING 1200)	3	LING 4010 Intro to Phonetics & Phonology (or LING 4010)	3
CS 1410 Intro to Object-Oriented Programming	3	CS 2420 Intro to Algorithms & Data Structures	3
		CS 3100 Models of Computation	3
Total	6	Total	9
Second Year Fall	Cr. Hr.	Second Year Spring	Cr. Hr.
CS 3500 Software Practice	3	CS 5340 Natural Language Processing	3
LING 3300 Computers and Language (or CS 3500)	3	LING 5300 Computational Linguistics	3
Total	6	Total	6