FORMAT 1

Submit original with signatures + 1 copy + electronic copy to Faculty Senate (Box 7500).
See http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures-/ for a complete description of the rules governing curriculum & course changes.

TRIAL COURSE OR NEW COURSE PROPOSAL
(Attach copy of syllabus)

SUBMITTED BY:

Department	Computer Science	College/School	CEM
Prepared by	Orion Lawlor	Phone	474-7678
Email Contact	lawlor@alaska.edu	Faculty Contact	Same

1. ACTION DESIRED

(CHECK ONE):

Trial Course		New Course	X

2. COURSE IDENTIFICATION:

Dept	CS	Course #	601	No. of Credits	4

Justify upper/lower division status & number of credits: Required course for MS CS degree. Standard lecture format with 4 contact hours/week.

3. PROPOSED COURSE TITLE: Algorithms, Architecture and Languages

4. To be CROSS LISTED?
YES/NO — NO   If yes, Dept: ___   Course # ___

NOTE: Cross-listing requires approval of both departments and deans involved. Add lines at end of form for additional required signatures.

5. To be STACKED?*
YES/NO — NO   If yes, Dept. ___   Course # ___

How will the two course levels differ from each other? How will each be taught at the appropriate level?:	

* Use only one Format 1 form for the stacked course (not one for each level of the course!) and attach syllabi. Stacked course applications are reviewed by the (Undergraduate) Curricular Review Committee and by the Graduate Academic and Advising Committee. Creating two different syllabi (undergraduate and graduate versions) will help emphasize the different qualities of what are supposed to be two different courses. The committees will determine: 1) whether the two versions are sufficiently different (i.e. is there undergraduate and graduate level content being offered); 2) are undergraduates being overtaxed?; 3) are graduate students being undertaxed? In this context, the committees are looking out for the interests of the students taking the course. Typically, if either committee has qualms, they both do. More info online – see URL at top of this page.

6. FREQUENCY OF OFFERING: Spring

Fall, Spring, Summer (Every, or Even-numbered Years, or Odd-numbered Years) — or As Demand Warrants

7. SEMESTER & YEAR OF FIRST OFFERING (Effective AY2015-16 if approved by 3/31/2015; otherwise AY2016-17)

Spring 2016

8. COURSE FORMAT:

NOTE: Course hours may not be compressed into fewer than three days per credit. Any course compressed into fewer than six weeks must be approved by the college or school's curriculum council. Furthermore, **any core course compressed to less than six weeks must be approved by the Core Review Committee.**

COURSE FORMAT: (check all that apply)	1	2	3	4	5	X	6 weeks to full semester

OTHER FORMAT (specify)	

Mode of delivery (specify lecture, field trips, labs, etc)	Lecture

9. *CONTACT HOURS PER WEEK:*	4	LECTURE hours/weeks	0	LAB hours /week	0	PRACTICUM hours /week

Note: # of credits are based on contact hours. 800 minutes of lecture=1 credit. 2400 minutes of lab in a science course=1 credit. 1600 minutes in non-science lab=1 credit. 2400-4800 minutes of practicum=1 credit. 2400-8000 minutes of internship=1 credit. This must match with the syllabus. See http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures-/guidelines-for-computing-/ for more information on number of credits.

OTHER HOURS (specify type)

10. COMPLETE CATALOG DESCRIPTION including dept., number, title, credits, credit distribution, cross-listings and/or stacking (50 words or less if possible):

Example of a complete description:

FISH F487 W, O   Fisheries Management
3 Credits   Offered Spring
Theory and practice of fisheries management, with an emphasis on strategies utilized for the management of freshwater and marine fisheries. *Prerequisites: COMM F131X or COMM F141X; ENGL F111X; ENGL F211X or ENGL F213X; ENGL F414; FISH F425; or permission of instructor.* Cross-listed with NRM F487. (3+0)

CS F601   Algorithms, Architecture and Languages
4 Credits   Offered Spring
Current research on, and cross-cutting interrelationships between computer algorithms, machine architecture, and languages. Covers asymptotic performance analysis including NP-completeness, modern parallel hardware including multicore, and grammars and parsing from regular expressions to BNF. *Prerequisites: CS F331; CS F411; CS F441 or EE F443.* (4+0)

11. COURSE CLASSIFICATIONS: Undergraduate courses only. Consult with CLA Curriculum Council to apply S or H classification appropriately; otherwise leave fields blank.

H = Humanities		S = Social Sciences	

Will this course be used to fulfill a requirement for the baccalaureate core? **If YES, attach form.**	YES:	NO:

IF YES, check which core requirements it could be used to fulfill:

O = Oral Intensive, **Format 6**	W = Writing Intensive, **Format 7**	X = Baccalaureate Core

11.A Is course content related to northern, arctic or circumpolar studies? If yes, a "snowflake" symbol will be **added in the printed Catalog, and flagged in Banner.**

YES	NO	X

12. COURSE REPEATABILITY:

Is this course repeatable for credit?	YES		NO	X

Justification: Indicate why the course can be repeated (for example, the course follows a different theme each time).

How many times may the course be repeated for credit?		**TIMES**
If the course can be repeated for credit, what is the maximum number of credit hours that may be earned for this course?		**CREDITS**
If the course can be repeated with <u>variable</u> credit, what is the maximum number of credit hours that may be earned for this course?		**CREDITS**

13. GRADING SYSTEM: Specify only one. Note: Changing the grading system for a course later on constitutes a Major Course Change – Format 2 form.

LETTER:	X	PASS/FAIL:	

RESTRICTIONS ON ENROLLMENT *(if any)*

14. PREREQUISITES	CS 331; CS 411 ; CS 441 or EE 443

These will be *required* before the student is allowed to enroll in the course.

15. SPECIAL RESTRICTIONS, CONDITIONS	

16. PROPOSED COURSE FEES	$0

Has a memo been submitted through your dean to the Provost for fee approval?
Yes/No

17. PREVIOUS HISTORY

Has the course been offered as special topics or trial course previously?   NO
Yes/No

If yes, give semester, year, course #, etc.:

18. ESTIMATED IMPACT
WHAT IMPACT, IF ANY, WILL THIS HAVE ON BUDGET, FACILITIES/SPACE, FACULTY, ETC.

A faculty member to teach the course once a year and a classroom for the course. This offering will replace the yearly offering of CS 631.

19. LIBRARY COLLECTIONS
Have you contacted the library collection development officer (kljensen@alaska.edu, 474-6695) with regard to the adequacy of library/media collections, equipment, and services available for the proposed course? If so, give date of contact and resolution. If not, explain why not.

No	X	Yes		No library resources are necessary

20. IMPACTS ON PROGRAMS/DEPTS
What programs/departments will be affected by this proposed action?
Include information on the Programs/Departments contacted (e.g., email, memo)

This will only affect the MS and BS/MS programs in CS.

21. POSITIVE AND NEGATIVE IMPACTS
*Please specify **positive and negative** impacts on other courses, programs and departments resulting from the proposed action.*

We had noticed declining interest in the MS mainly due to students being required to take 12 credits of mostly old topics. This course will contain important and leading-edge topics that MS graduates in CS need to know.
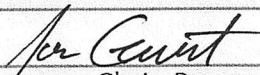
Having an updated MS degree will allow us to effectively advertise again. The two previous times (~ 2002 and 2005) resulted in over 10 new MS students per year. We expect similar results from a new advertising effort.
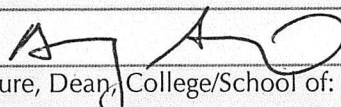
JUSTIFICATION FOR ACTION REQUESTED
The purpose of the department and campus-wide curriculum committees is to scrutinize course change and new course applications to make sure that the quality of UAF education is not lowered as a result of the proposed change. Please address this in your response. This section needs to be self-explanatory. Use as much space as needed to fully justify the proposed course.

This course is part of the update to the MS and BS/MS degrees. The required content to cover has been brought up-to-date and split across two courses: CS 600 and CS 601. The content of CS 601 allows more cross-cutting issues to be explored, as opposed to covering topics in isolation.

APPROVALS: *Add additional signature lines as needed.*

	Date	9/24/14
Signature, Chair, Program/Department of: CS		

	Date	9-25-14
Signature, Chair, College/School Curriculum Council for: CEM		

	Date	10/3/14
Signature, Dean, College/School of: CEM		

Offerings above the level of approved programs must be approved in advance by the Provost.

	Date	
Signature of Provost (if above level of approved programs)		

ALL SIGNATURES MUST BE OBTAINED PRIOR TO SUBMISSION TO THE GOVERNANCE OFFICE

	Date	
Signature, Chair		

Faculty Senate Review Committee: ___Curriculum Review   ___GAAC

             ___Core Review   ___SADAC

ADDITIONAL SIGNATURES: *(As needed for cross-listing and/or stacking)*

	Date	
Signature, Chair, Program/Department of:		

	Date	
Signature, Chair, College/School Curriculum Council for:		

	Date	
Signature, Dean, College/School of:		

ATTACH COMPLETE SYLLABUS (as part of this application). This list is online at:

http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures-/uaf-syllabus-requirements/

The Faculty Senate curriculum committees will review the syllabus to ensure that each of the items listed below are included. If items are missing or unclear, the proposed course (or changes to it) may be underlined denied.

SYLLABUS CHECKLIST FOR ALL UAF COURSES

During the first week of class, instructors will distribute a course syllabus. Although modifications may be made throughout the semester, this document will contain the following information (as applicable to the discipline):

1. Course information:
 ❏Title, ❏ number, ❏credits, ❏prerequisites, ❏ location, ❏ meeting time
(make sure that contact hours are in line with credits).

2. Instructor (and if applicable, Teaching Assistant) information:
 ❏ Name, ❏ office location, ❏ office hours, ❏ telephone, ❏ email address.

3. Course readings/materials:
 ❏ Course textbook title, ❏ author, ❏ edition/publisher.
 ❏ Supplementary readings (indicate whether ❏ required or ❏ recommended) and
 ❏ any supplies required.

4. Course description:
 ❏ Content of the course and how it fits into the broader curriculum;
 ❏ Expected proficiencies required to undertake the course, if applicable.
 ❏ Inclusion of catalog description is *strongly* recommended, and
 ❏ Description in syllabus must be consistent with catalog course description.

5. ❏ Course Goals (general), and (see #6)

6. ❏ Student Learning Outcomes (more specific)

7. Instructional methods:
 ❏ Describe the teaching techniques (eg: lecture, case study, small group discussion, private instruction, studio instruction, values clarification, games, journal writing, use of Blackboard, audio/video conferencing, etc.).

8. Course calendar:
 ❏ A schedule of class topics and assignments must be included. Be specific so that it is clear that the instructor has thought this through and will not be making it up on the fly (e.g. it is not adequate to say "lab". Instead, give each lab a title that describes its content). You may call the outline Tentative or Work in Progress to allow for modifications during the semester.

9. Course policies:
 ❏ Specify course rules, including your policies on attendance, tardiness, class participation, make-up exams, and plagiarism/academic integrity.

10. Evaluation:
 ❏ Specify how students will be evaluated, ❏ what factors will be included, ❏ their relative value, and ❏ how they will be tabulated into grades (on a curve, absolute scores, etc.) ❏ Publicize UAF regulations with regard to the grades of "C" and below as applicable to this course. (Not required in the syllabus, but is a convenient way to publicize this.) Link to PDF summary of grading policy for "C":
http://www.uaf.edu/files/uafgov/Info-to-Publicize-C_Grading-Policy-UPDATED-May-2013.pdf

11. Support Services:
 ❏ Describe the student support services such as tutoring (local and/or regional) appropriate for the course.

12. Disabilities Services: Note that the phone# and location have been **updated.** http://www.uaf.edu/disability/ The Office of Disability Services implements the Americans with Disabilities Act (ADA), and ensures that UAF students have equal access to the campus and course materials.
 ❏ State that you will work with the Office of Disabilities Services (208 WHITAKER BLDG, 474-5655)to provide reasonable accommodation to students with disabilities.

5/21/2013

CS601 Algorithms, Architecture, and Languages (Proposed Course)

Course 99999	**Instructor** Orion Lawlor
Section F01	**Phone** 907-474-7678
Credits 4 + 0	**Office** Chapman 201E
Prerequisites: CS331 CS411 CS441 or EE443	**Email** lawlor@alaska.edu **Office Hours** TR 11:30 a.m. - 1 p.m.
Meeting Time MTWR noon - 1 p.m.	**Course Website** /courses/cs601/2015-spring/
Room Chapman 104	**Required Texts** (NTO) The New Turing Omnibus: Sixty-Six Excursions in Computer Science, by A. K. Dewdney

Course Description

Current research on, and cross-cutting interrelationships between computer algorithms, machine architecture, and languages. Covers asymptotic performance analysis including NP-completeness, modern parallel hardware including multicore, and grammars and parsing from regular expressions to BNF.

Tentative Schedule

Thu, Jan 15
- First day of instruction
  - Volunteer for lecture topics through spring break

Mon, Jan 19
- Alaska Civil Rights Day (no classes, most offices closed)

Tue, Jan 20
- Godel's incompleteness theorem & computability (NTO 5)

Wed, Jan 21
- Turing machines, and the halting problem (NTO 59)

Thu, Jan 22
- Noncomputable functions: busy beaver (NTO 39)

Mon, Jan 26
- Physical models for computation (NTO 33)
  - Homework: Turing Machines

Tue, Jan 27
- Turing machine simulation (NTO 31) & virtualization

Wed, Jan 28
- Chomsky hierarchy of languages (NTO 7)

Thu, Jan 29
- Pumping lemma (NTO 14) & non-regular languages

Fri, Jan 30
- Deadline for student- and faculty-initiated drops (course does not appear on academic record)

Mon, Feb 02
- Regular languages, and regular expression syntax
  - Homework: lexer design

Tue, Feb 03
- Lexer design in compilers

Wed, Feb 04
- String substitutions and halting (NTO 63)

Thu, Feb 05
- PROJECT: Preliminary proposals for semester projects

Mon, Feb 09
- Nondeterminism: NFA to DFA (NTO 26)
  - Homework: YACC

Tue, Feb 10

- Context Free Grammars, parsing, and compiler design

Wed, Feb 11
- Bottom-up and shift-reduce parsing, LALR

Thu, Feb 12
- YACC and BNF: LALR in practice

Sun, Feb 15
- Deadline to apply for spring 2015 graduation

Mon, Feb 16
- Introduction to graph data structures & algorithms
  - Homework: graph library

Tue, Feb 17
- Review: Prim's greedy minimum spanning tree (NTO 22)

Wed, Feb 18
- Traveling Salesman Problem, with application to 3D printer path planning

Thu, Feb 19
- Satisfiability and graph coloring (NTO 34)

Mon, Feb 23
- Boolean normal forms & circuits (NTO 13), with application to ASIC design
  - Homework: P vs NP

Tue, Feb 24
- NP Completeness and SAT (NTO 41)

Wed, Feb 25
- Proving NP-Completeness (NTO 54)

Thu, Feb 26
- Dynamic programming: filling in tables (NTO 601), with application to DNA sequencing

Mon, Mar 02
- Random and pseudorandom numbers (NTO 8)
  - Homework: Monte Carlo

Tue, Mar 03
- Monte Carlo integration, with application to financial modeling

Wed, Mar 04
- Probabilistic Algorithms: Rabin prime finding (NTO 50), with application to RSA encryption

Thu, Mar 05
- Approximate solutions to NP-hard problems

Mon, Mar 09
- Multi-precision arithmetic, with application to encryption on prime groups
  - Homework: RSA

Tue, Mar 10
- Number systems and base conversion, Chinese remainder theorem (NTO 42)

Wed, Mar 11
- Rivest-Shamir-Adleman (RSA) public key encryption

Thu, Mar 12
- PROJECT: Prior work reports

Fri, Mar 13
- Deadline for student- and faculty-initiated withdrawals (W grade appears on academic transcript)

Mon, Mar 16
- Spring break begins (no classes)

Fri, Mar 20
- Spring break--most offices closed

Mon, Mar 23
- Physical machines and silicon (NTO 56), with application to chip fabrication
  - Volunteer for lecture topics through final exam

Tue, Mar 24
- Triumph of the MOSFET, and quantum effects on modern silicon

Wed, Mar 25
- Shor factoring on quantum computers

Thu, Mar 26

- Adiabatic quantum machines and annealing

Mon, Mar 30
- Parallel computing machine topologies (NTO 62)
  - Homework: OpenMP + AVX

Tue, Mar 31
- Multicore, atomics, and locks

Wed, Apr 01
- SIMD: regular parallelism, with application to high-speed decryption

Thu, Apr 02
- Mixing SIMD and Multicore memory access

Mon, Apr 06
- GPU programming: fragment shaders
  - Homework: GPU

Tue, Apr 07
- GPU programming: CUDA

Wed, Apr 08
- Rendering the mandelbrot set per pixel (NTO 9)

Thu, Apr 09
- Cellular Automata: Conway's game of life (NTO 44)

Mon, Apr 13
- Floating point representation and roundoff
  - Homework: floating point

Tue, Apr 14
- Newton-Raphson root finding and convergence (NTO 21)

Wed, Apr 15
- Multi-precision floating point arithmetic, and Dekker addition

Thu, Apr 16
- Fast Multiplication: Karatsuba & Strassen (NTO 25)

Mon, Apr 20
- Genetic algorithms and crossover-friendly genomes (NTO 19)
  - Homework: neural networks

Tue, Apr 21
- Neural Network topology & training (NTO 36)

Wed, Apr 22
- Data compression via Huffman trees (NTO 52)

Thu, Apr 23
- Reed-Solomon error correcting codes

Fri, Apr 24
- SpringFest (no classes)

Mon, Apr 27
- Comprehensive exam after-action (part 1)

Tue, Apr 28
- Comprehensive exam after-action (part 2)

Wed, Apr 29
- PROJECT: Final presentations

Thu, Apr 30
- PROJECT: Final presentations cont'd

Mon, May 04
- PROJECT: Final presentations cont'd

Mon, May 04
- Last day of instruction

Tue, May 05
- Final exam, held in class

Grading Policies

| Weight | Description |

10%	Attendance and participation in daily class discussions
15%	In-class lecture preparation and delivery
20%	Homeworks and technical writeups of course material presented in class
25%	Semester project: a written proposal, experimental work, writeup, and a presentation.
30%	Final exam: a comprehensive written exam.

Grades will be assigned based on the following percentage intervals:

A+	:[99%, 100%)	A	:[93%, 99%)	A-	:[90%, 93%)	B+	:[87%, 90%)	B	:[83%, 87%)
B-	:[80%, 83%)	C+	:[77%, 80%)	C	:[70%, 77%)	C-	:[70%, 70%)	D+	:[67%, 70%)
D	:[63%, 67%)	D-	:[60%, 63%)	F	:[0%, 60%)						

Course Format

Each day of class will begin with a half hour lecture, surveying and describing the course material. The second half hour of each class will be a moderated discussion between the presenter, instructor, other students in the course, and invited guests.

To prepare an effective lecture, you must not only read the starter source material provided by the instructor, but also find, read, and evaluate other scholarly sources, for example via Google Scholar . Lecture grades will be based on your written lecture outline submitted to the instructor before class; the quality of your slides, diagrams, videos, or other visual aids during the presentation; your ability to engage the audience; and your demonstrated depth and clarity of understanding of the subject and how it relates to the broader field.

- A grade "A" lecturer works to find and understand related papers, finds and focuses on the key areas, spends significant effort on interactive examples and demonstrations, practices their talk, and presents the material clearly and in context.
- A grade "B" lecturer finds a few related papers and some tangential ones, agglomerates them into a powerpoint with text and figures, and delivers a rambling and still incomplete talk.
- A grade "C" lecturer reads the book, prepares text-only powerpoint slides, reads them, and puts the audience to sleep.

To be prepared for the in-class discussion each day, you must at a minimum read the lecture notes, and the related book chapter and/or technical papers. Discussion grades will be based on attendance, the quality of questions asked, and your demonstrated engagement with both the subject and discussion. The use of laptops or tablets during the lecture to take notes, run experiments, and seek out related scholarly information is highly encouraged, but their use to check email or write unrelated code is not.

Our emphasis on clear written and oral communication skills is not to the exclusion of technical work, but due to the fact that employment, funding, and recognition all require both technical and communication skills!

Student Learning Outcomes

Students finishing this course will be able to:

- Explain how to determine if a problem is NP-Complete.
- Explain limits on computability, such as the busy beaver problem.
- Explain LALR parser generation, such as in a YACC parser.
- Design and construct parallel programs using at least one of multicore, SIMD, or GPU.
- Read and write technical literature, such as program documentation, white papers, and academic journal articles.

Policies

Students are expected to be at every class meeting on time, and are responsible for all class content, whether present or not. If absence from class is necessary, in-class work (other than quizzes) and homework may be made up only if the instructor is notified as soon as possible; in particular, absences due to scheduled events must be arranged ahead of time. Academic dishonesty will not be tolerated, and will be dealt with according to UAF procedures. Students in this class must pay the CS lab fee. Payment allows access to the Chapman 103 lab.

UAF academic policies http://www.uaf.edu/catalog/current/academics

CS Department policies http://www.cs.uaf.edu/departmental-policies

Disabilities Services:

The UAF Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UAF students have equal access to the campus and course materials. I will work with the UAF Office of Disability Services (208 WHITAKER BLDG, 474-5655) to provide reasonable accommodation to students with disabilities.

Updated: 2014-09-15