WINONA STATE UNIVERSITY
PROPOSAL FOR REVISED COURSES

Department Computer Science
Date 4/17/2011

If proposed course change requires A2C2 and/or graduate Council approval, i.e., not considered a notification, complete and submit this form with the appropriate number of copies. Refer to Regulation 3-4, Policy for Changing the Curriculum, for complete information on submitting proposals for curricular changes.

Current Course Information

<table>
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<tr>
<th>Course No.</th>
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<td>Introduction to Bioinformatics</td>
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This Proposal is for a(n) Undergraduate Course Graduate Course

Applies to: Major Minor University Studies

Required Required Not for USP

X Elective

Prerequisites CS 250 and BIOL 241

Grading Grade only P/NC only Grade and P/NC Option

Frequency of offering Once every year or once every other year

Proposed Course Information. (Please indicate only proposed changes below.)

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A. Changes in the course description,
   1. Catalog description (include a display of current and proposed course requirements).

   Current catalog description:
   CS 368 - Introduction to Bioinformatics - 3 S.H.
   This course introduces students to the fundamental concepts of bioinformatics. Topics include introduction to DNA machinery and informatics, pairwise sequence alignments, bioinformatics programming, bioinformatics tools and database searches, genomics and proteomics, and introduction to DNA microarray analysis. Prerequisite: CS 250 and BIOL 241.

   Proposed catalog description: (The differences in the proposed description are in blue.)
   CS 368 - Introduction to Bioinformatics - 4 S.H.
   This course introduces students to the fundamental concepts of bioinformatics. Topics include introduction to DNA machinery and informatics, pairwise sequence alignments, bioinformatics programming, bioinformatics tools and database searches, phylogenetics analysis, genomics and proteomics, and introduction to DNA microarray analysis, sequencing techniques and algorithms. Advanced topics such as systems biology and HMM will be introduced as necessary. Prerequisite: CS 250 and BIOL 241.

   2. Course outline of the major topics and subtopics (minimum of two-level outline).
   The proposed additions to the current CS 368 are in blue.
   * DNA’s Information Content
- Overview of bioinformatics
- Central dogma of molecular biology
- Information storage in DNA and genetics code
  - The Human Genome Project and beyond

- Sequence Alignment
  - Dynamic programming
  - Pairwise sequence alignments
    - Global sequence alignment
    - Local sequence alignment
    - Gaps in sequence alignment

- Bioinformatics Databases
  - Biological databases
    - Gene databases
    - Protein databases
  - Sequence search
    - Programs and algorithms
    - BLAST
    - FASTA

- Bioinformatics programming and tools
  - Specific programming language, as needed – e.g., Perl
    - Introduction to language
    - Arrays and hashes
    - File I/O and control structures
    - Functions and subroutines
  - Regular expression and substitution patterns
  - BioPerl
  - Other tools of molecular biology

- Phylogenetic Analysis
  - Distance-based methods
  - Parsimony methods
  - Probabilistic methods

- Genomic Information Content
  - Prokaryotic and eukaryotic genomes & gene structures
  - Gene recognition
  - Gene expression
  - Introduction to microarrays
    - Techniques
    - Fundamental data analysis
  - Genome rearrangements

- Proteomic Information Content
  - Predicting RNA secondary structure
  - Protein secondary structure
  - Protein folding
  - Structural modeling and visualization
  - Proteomics, protein classification and modification

- Sequencing Techniques and Algorithms
  - Sequencing techniques
    - Sanger sequencing
    - Next-generation sequencing
  - Sequence reassembly
  - Sequence realignment

- Advanced topics

3.a Instructional delivery methods utilized: (Please check all that apply).

<table>
<thead>
<tr>
<th>Lecture: Auditorium</th>
<th>X ITV</th>
<th>Online</th>
<th>X Web Enhanced</th>
<th>X Web Supplemented</th>
</tr>
</thead>
<tbody>
<tr>
<td>X Lecture: Classroom</td>
<td>Service Learning</td>
<td>Travel Study</td>
<td>X Laboratory</td>
<td>Internship/Practicum</td>
</tr>
</tbody>
</table>
3.b. MnSCU Course media codes: (Please check all that apply).

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<tr>
<td>3. Internet</td>
<td>Predominately = where all, or nearly all, course activity occurs in an online environment. One to two activities may occur face-to-face in a classroom, with the maximum being two activities.</td>
</tr>
<tr>
<td>4. ITV Sending</td>
<td>a course in which students are in the classroom with the instructor, other students join via interactive television technology from other geographically separate locations</td>
</tr>
<tr>
<td>5. Broadcast TV</td>
<td></td>
</tr>
<tr>
<td>6. Independent Study</td>
<td></td>
</tr>
<tr>
<td>7. Taped</td>
<td>a course in which the teacher records the lessons for playback at a later date</td>
</tr>
<tr>
<td>8. ITV Receiving</td>
<td></td>
</tr>
<tr>
<td>9. Web Enhanced</td>
<td>For a course in which students are geographically separate from the teacher and other students for a majority of required activities. However, some on-site attendance is required. The course includes synchronous and/or asynchronous instruction.</td>
</tr>
<tr>
<td>10. Web Supplemented</td>
<td>No Reduced Seat Time: For a course utilizing the web for instructional activities. Use of this code may assist your college/university in tracking courses for “smart classrooms” and/or facility usage.</td>
</tr>
</tbody>
</table>

The evaluation for this course will be based on exams, programming projects, homework assignments, laboratory reports, and presentation. The class will include two exams. The programming assignments will be done using programming languages commonly used in bioinformatics such as Perl and Java.

B. Rationale for each of the changes proposed.

The major reason of the change is to align with the department’s curriculum revision with the goal to deliver curriculum contents more efficiently. The proposed change will integrate the existing two three-credit bioinformatics courses to one four-credit course. It will also adopt the “Web Enhanced” delivery method to utilize

C. Impact of this Course on other Departments, Programs, Majors, or Minors

1. Does this course increase or decrease the total credits required by a major or minor of any other department? If so, which department(s)?
   No.

2. List the department(s), if any, which have been consulted about this proposal.
   None.

D. Describe impacts of this proposal on the University Studies Program.

None.

Definitions:

01-Satellite:

02-CD Rom:

03-Internet:

04-ITV Sending:

05-Broadcast TV:

06-Independent Study:

07-Taped:

08-ITV Receiving:

09-Web Enhanced:

10-Web Supplemented:

Attach an Approval Form with appropriate signatures.

Department Contact Person for this Proposal:

Chi-Cheng Lin  
507-285-7145  
clin@winona.edu