Montana Tech General Education Curriculum Application

Course Application

1. Course number and title:

   CSCI 101/102 Computational Thinking and Computational Thinking with Lab

2. Course credits:

   CSCI 101: 2 credits (course without the lab)
   CSCI 102: 3 credits (course with the lab)

3. Course outcomes:

   CSCI 101 and 102:
   1. Students identify problem types and appropriate approaches and strategies to solve those types of problems.
   2. Students analyze problems for their information content and problem structure.
   3. Students apply problem solving strategies appropriately and effectively according to problem type.
   4. Students evaluate written descriptions, accounts, and arguments, and identify ambiguities, assumptions and fallacies in reasoning.
   CSCI 102 only:
   5. Students write computer programs which demonstrate the problem solving constructs and approaches discussed in class.

4. Course prerequisites:

   None

5. Please give the last semester the course was offered and the next semester the course will be offered.

   Last taught Fall 2011 / Will teach again Fall 2012

6. Please identify what general education student outcomes (see page 1) students taking this course will satisfy:

   3. Students will be able to reason analytically and quantitatively at an algebraic level.
   8. Students will be able to demonstrate proficient critical thinking skills.

7. Please attach or include the following:

   (a) The course syllabus.
   See attached syllabi.

   (b) A summary of course assignments that address the student outcomes listed in (6).
   See attached assignments.

In addition to the assignments, students in the combined CSCI101/102 lecture section are given the Whimbey Analytical Skills Inventory (WASI) test on the first day of class, and a different version of the test at the end of the semester. The results on these tests have been measured over three offerings of the course. For the sake of comparison, only those students who took both tests were included in statistical analysis (not all students attend the first day of class, and not all attend when the post-test is given). Students were not told they would be taking the test because I didn't want them to study – I was really trying to measure how well they incorporated the material over the semester and if the course had helped their analytical

skills. There was a highly statistically significant difference (increase) between pre- and post-test scores with $p<0.01$ on the student t-test ($p=0.00002667$) over the past three class offerings.

Although the Computational Thinking course addresses some mathematical skills, it is my thinking that it should *not* be included in the math general education list. I think that the focus of the course is more about problem solving and logic in general and thus fits better with the Philosophy courses that cover logic. (I would hate to see students avoiding taking a more rigorous math class in favor of this one since I don't think this class covers as much math as a college graduate should have once they graduate.)

8. Approved by Department Head: Jeff Braun
9. Approved by College Dean: Doug Loe
10. Approved by General Education Committee: _____
    Chair
11. Approved by Faculty Senate: _____

CSCI 102 – Computational Thinking with Lab
Syllabus
Fall 2011

Instructor Michele Van Dyne
Office: Museum 204B
Telephone: 406-496-4855
Office Hours: WF 11:00-12:00
R 9:30-10:30
Or by appointment

Classroom Meetings

Lecture – WF, 2:00 – 2:50, CBB 105
Lab – M, 2:00 – 4:50, ENGR 204

Course Description

Computational thinking involves solving problems, designing systems, and understanding human behavior, by drawing on the concepts fundamental to computer science. It is the study of an effective approach used by people to solve problems, not trying to get humans to think like computers. Critical thinking involves the systematic evaluation of information, and is a crucial piece of problem solving. The two are combined in this course to provide the student with a powerful set of tools to understand and solve the kinds of problems they will encounter in their college studies and future careers.

The lab incorporates a programming component in problem solving. In this lab, students learn to carefully and systematically analyze problems and demonstrate the correctness of their solution by implementing it in program code.

Prerequisites / Expectations

There are no prerequisites for this class, except that students have been accepted for admission to Montana Tech.

Course Outcomes

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5. Students write computer programs which demonstrate the problem solving constructs and approaches discussed in class.

Textbook

No textbook required.

Optional Texts and Resources:
Arthur Wimbey and Jack Lochhead, *Problem Solving and Comprehension, 6th Edition*, Psychology Press, 1999.
M. Neil Browne and Stuart M. Keeley, *Asking the Right Questions: A Guide to Critical Thinking, 9th Edition*, Prentice-Hall / Pearson Publishing, 2010.
Chuck Clayton, *The Rediscovery of Common Sense: A Guide to the Lost Art of Critical Thinking*, iUniverse, 2007.
Anthony Weston, *A Rulebook for Arguments, 4th Edition*, Hackett Publishing Company, 2009.
Morgan D. Jones, *The Thinker's Toolkit: 14 Powerful Techniques for Problem Solving*, Three Rivers Press, 1999.

Grading and Exams

Evaluation Item:	Percent of Grade:
Final Exam	20%
12 Assignments, Equally Weighted	40%
11 Lab Assignments, Equally Weighted	40%

Policies

Class Participation: Please ask questions as they come up during class, don't wait until the end. If you don't understand something, chances are there are others who don't either. If you have any comments or contributions, again, also speak up. I would like the class to be as interactive as possible. Finally, expect me to randomly ask questions, some of which may simply be for discussion – there may be no right or wrong answers. It is very important to keep up with the homework and to attend class. Expect to spend 3-5 hours a week on homework.

Due Dates: No late homework. Homework assignments will be made available at the start of when that particular topic is to be covered. If you complete the assignments as the information becomes available, you won't have to scramble the night before it's due to complete it. If there are extenuating circumstance, please come talk to me.

Cheating: Hopefully it goes without saying, but cheating won't be tolerated. You are expected to do your own work on assignments and on exams. Cell phones will not be allowed in exams.

Communications: We will use Moodle and Montana Tech email for posting assignments, grades, and for communications.

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Syllabus
Fall 2011

Instructor Michele Van Dyne
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Grading and Exams

Evaluation Item:	Percent of Grade:
Final Exam	35%
12 Assignments, Equally Weighted	65%

Policies

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Assignments Common to CSCI 101 and CSCI 102:

CSCI 101 – COMPUTATIONAL THINKING

ASSIGNMENT #: 1
DUE DATE: 9/2/2011
POINTS: 50
TOPIC: Verbalizing Problem Solutions

Below are two math problems. You need only complete one for this assignment. If you work with a partner from class, you and your partner should each do a different problem. If you work with someone from outside the class, you can choose which problem you want to do.

You are to work as the problem solver with someone else as the listener. As you solve the problem you've chosen, you should verbalize exactly what you are thinking and ask the listener to record what you are saying and doing. You should ask the person listening to continually check your accuracy as you work. The listener can question your approaches, but should ***not*** provide any answers or clues. The listener should also prompt you to talk out loud should you stop talking.

You are to turn in:
1. Who was your listener?
2. Everything that was written down during the process of verbalizing and solving the problem.
3. The final solution to the problem.
4. A description of your observations of the process. Did it force you to think more clearly about the problem? Was it difficult to continue verbalizing? Were you able to catch mistakes or wrong turns as a result of verbalizing, without the listener's input? Any other observations?

Problem 1: The number of cows owned by farmer Smith is the number owned by farmer Thompson divided by the number owned by farmer Jones. If farmer Thompson, who owns 42 cows, had 14 more cows, he would own 8 times as many cows as farmer Jones. How many cows does farmer Smith own?

Problem 2: Paul sold 160 sandwiches for $2.00 each. Each sandwich consisted of 4 oz. of ham, 2 slices of bread, and mustard. Paul paid $3.00 a pound for the ham, $.60 a loaf for the bread (20 slices per loaf) and used 8 jars of mustard at $.50 each. How much profit did he make?

CSCI 101/102 – COMPUTATIONAL THINKING

ASSIGNMENT #: 2
DUE DATE: 9/9/2011
POINTS: 50
TOPIC: Analogy Problems

Choosing Relationship Sentences

For the analogies listed below, there are three relationship sentences. Choose the correct one. (5 points each)

Roar is to *sea* as *howl* is to *wind*.
a. _____ is the sound of water crashing in the _____.
b. _____ is the sound of turbulent air of the _____.
c. _____ is the sound of _____.

Surgeon is to *scalpel* as *writer* is to *words*.
a. The tool of the _____ is (the) _____.
b. A _____ performs appendectomies with a _____.
c. A _____ uses _____ to communicate ideas.

Writing Relationship Sentences

For the analogies listed below, write a relationship sentence that is valid for both pairs of words. (5 points each)

Verdict is to *jury* as *sentence* is to *judge*.
Relationship sentence:

Always is to *often* as *never* is to *seldom*.
Relationship sentence:

50 is related to *20* as *90* is related to *60*.
Relationship sentence:

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Solving Analogies

Using what you have learned about relationship sentences, solve the following analogies. ***Write the relationship sentence you used for each***. (5 points each)

_____ is to *carbohydrate* as *butcher* is to _____.

a. baker : meat
b. baker : protein
c. calories : protein
d. potato : protein

Relationship sentence:

_____ is to *right* as *weather* is to _____.

a. wrong : climate
b. left : rain
c. write : whether
d. correct : report

Relationship sentence:

Dress is to *wool* as _____ is to _____.

a. animal : dog
b. suit : jacket
c. door : glass
d. concrete : building

Relationship sentence:

_____ is to *grass* as _____ is to *sales*.

a. homeowner : customer
b. fertilizer : advertising
c. seed : recession
d. weed killer : recession

Relationship sentence:

Miami is to *city* as _____ is to _____.

a. state : Florida
b. Lincoln : president
c. city : state
d. city : south

Relationship sentence: