This test has 2 pages. Write your name, the course number and “Test 1” on the exam booklet.

Books, notes, calculators, computers and phones are not permitted. Work on the questions in the order that you want, but try to write your answers in order in the booklet.

If a question asks for C++ code, don’t worry about remembering every little detail of C++ syntax. Minor details will not affect your grade.

Hand in your copy of the exam. Place it in the booklet. You’ll get it back.

1. (32%) Answer each of the following questions briefly but precisely.

   (a) What is a software specification?
   (b) What is data abstraction?
   (c) What two activities does the implementation of software involve?
   (d) What is a constructor?
2. (68%) Create a class Product. Each object in this class represents a product that has a number, a description and a price. The number is a positive integer, the description is a string and the price is a real number. A product description can contain multiple words. The class should enforce data abstraction and support object-oriented programming. Include the following methods in the class. Whenever appropriate, declare methods to be inline. (Don’t forget to implement the methods.)

(a) A default constructor that initializes the product to have number 0, description invalid and price $-1$.

(b) A constructor Product (number, description, price) that initializes the product to the given values. The arguments are of type int, string and double, respectively.

(c) A method price() that returns the price of the product.

(d) A method print(out) that prints the product to output stream out in the following format:

   Number, Description: Price

   The price should be preceded by a dollar sign ($). Assume that all prices already have exactly two digits after the decimal point.

(e) A method read(in) that reads the product from input stream in. Assume that the number, description and price of the product are given on separate lines, in that order:

   Number
   Description
   Price

   No error-checking is performed.

(f) A method less_than(product2) that returns true if the number of the receiver is less than the number of product given as argument.