**Csci 1523**
**1523 Inclass Laboratory Module 07 - Modules**

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This lab contains 4 pages (including this cover page) and 1 problems. Check to see if any pages are missing.

It is our expectation that students will collaborate and share equally in the conduct of this exercise. However, we understand that often times students will not allocate sufficient time to the exercise thereby transferring responsibility for the completion of the exercise to their partner.

In the event a laboratory team is facing a situation in which one partner feels that an undue amount of the work in completion of the laboratory has been transferred on to them. This partner may elect to submit this work as a solo effort.

Your work in this case will be graded for you individually. No credit will be deducted in the event that partners decide to submit individual weekly efforts.

The laboratories typically consist of some short answer questions followed by a brief programming exercise. in answering your questions please PRINT your answers. In the event we cannot read your answers credit will be taken from your effort.

Also please PRINT LEGIBLY your full name in the space provided on this cover sheet. In the event we cannot read your name we will not award credit for the laboratory. All names should contain both your first name and last name.

**Laboratory Exercises**

1. Modules are a technique used in the development of Python applications which separate groups of functionally similar codes into Python files which may later be used in other applications. These Python files may subsequently be "imported" into other Python scripts where in the functions they contain may be reused.

   A Python application may in fact be a collection of imported modules with very little user developed code.

   Python modules typically have three sources:

   1. Modules delivered with the Python development environment.
   2. Modules supplied by third parties to support specific types of application development
   3. Modules developed by the application developer in order to modularize the application and perhaps reuse the codes in other application development efforts.

   The benefits of using modules have been outlined in our text but they are typically:

   1. Better software design approach by providing a natural means of dividing up programming tasks
   2. An efficient means for reusing codes
   3. Better quality assurance and quality control by creating separate units to be tested
   4. Easier program an system maintenance by providing a unit to isolate changes

   (a) **Creating a Python application using modules**
   Below in Listing 1 and 2 are two custom program modules. These modules have been kept small for the purposes of this exercise. The first of these modules calculates the velocity of an object dropped from a height, $h$, due to the acceleration of gravity. The second module calculates kinetic energy of a mass, $m$, given its velocity. In this exercise you will duplicate these modules in a directory on your computer. In that directory you will create a program which imports them and uses the calculations they contain to answer the questions given below.

Listing 1: Velocity Module

```
import math
# Function that computes the velocity of a freely
# falling object subject to an acceleration due to
# gravity, a, from an initial height of x.
#
# For the velocity function:
# x - expressed in meters
# a - expressed in meters/sec*sec
# Example calculation:
# Assume x = 100 meters, a = 9.8 meters/(sec^2)
#
# The velocity on impact with the ground would be:
#  v = 9.8 * sqrt(2.0*100/9.8)
#  v = 44.23 meters per sec

def velocity(a,x):
    v = a * math.sqrt(2.0*x/a)
    return v
```

Listing 2: Kinetic Energy Module

```
# Function that computes the kinetic energy of mass, m,
# at a velocity, v.
#
#
# For the kinetic energy function:
# m - expressed as kilograms
# v - expressed as meters per sec
#
# Example calculation, assume mass of 1 kilogram and a
# velocity of 100 meters per second.
#  ke = 0.5 * 1 * v ** 2
#  ke = 5000 kilogram-meters^2/sec^2.
#

def kinetic(v,m):
    ke = 0.5*m*v**2
    return ke
```

Assume that a person standing on a bridge that is 100 meters above a roadway below drops a 2.5 kilogram object from the bridge. What is the velocity of the object on hitting the roadway below and what is the kinetic energy contained in the object?

(b) **Speeding bullet equivalent** Using the code from the exercise and the knowledge that a bullet may travel at a velocity of 1200 meters/sec, how much would the typical bullet need to weigh in kilograms to contain the same

amount of kinetic energy that the 2.5 kilogram object had when dropped from the bridge as described above?