CS3311 Homework 3 Due date: **Friday**, September 29, 2017, by class time, 1:05pm
Submission: Typed, on Canvas (scanned submissions are not allowed)

The answers must be the original work of the author. While discussion with others is permitted and encouraged, the final work should be done individually. You are not allowed to work in groups. You are allowed to build on the material supplied in the class. Any other source must be specified clearly.

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1. *(40 points)*

Consider the following Python program that computes the sum of first n odd numbers and verifies that the sum is equal to n^2.

```
#
# Implements
# Sum of first n odd numbers is n^2
#

import operator

n = input('Pick a number greater than or equal to 0 for an upper limit: ')
print ('You entered n = %s. \n' % n)

pair = [1, 1]                  # the basis pair
print ('pair is %s \n' % pair)

for i in range (1,n+1):         # executes for i = 1, 2, ..., n
  pair[0] = pair[0] + 1
  pair[1] = pair[1] + pair[0]*2 - 1
  print ('pair is %s \n' % pair)

if operator.eq (pair[1],pair[0]**2):
  print "True: the second member of the pair is the square of the first."
else:
  print "False: the second member of the pair is not the square of the first."
```

Prove using induction that the program always prints
"`True:  the second member of the pair is the square of the first.`"

You must present the proof based on the code and on the number of iterations of the `for` loop. Clearly label the **basis**, **inductive hypothesis**, and **inductive step**.

Please flip the page for additional questions.

2. *(30 points)*

Consider the set L_1 of strings over $\Sigma = \{1, 2, a, b, c\}$ that start with "a" and end with "1".

Strings can have a length of two or greater.

(a) Give a recursive definition for L_1.

(b) Give a regular set for L_1.

3. *(30 points)*

Consider the set L_2 of strings over $\Sigma = \{1, 2, a, b, c\}$ that start and end with a number.

Strings can have a length of one or greater.

(a) Give a recursive definition for L_2.

(b) Give a regular set for L_2.