# CS 3100 – Models of Computation – Fall 2011

**Assignment 10 – Given 11/22/11 – version of 9:49am, 11/22/11**
**One Part Due 11/29/11 11:59pm – others due 12/04/11 11:59pm**
**100 points, 10% of assignment points**

- Part that's due 11/29: Project update. Please make a project website and present a report on work accomplished.
- Parts due 12/04: The remaining.
- Note: Assignment 11 on BDDs and Undecidability Proofs will be given out on 11/30/11, and due on the last day of classes. *So please do not procrastinate. Get most of your work done by 11/30/11.*

1. **(5 points** Please make a Final Project website, providing the following details of your project. **Submit the website URL through a single file ProjectWebsite.txt that is at least one page long.**
   - Project name
   - Group members and email addresses
   - Exact project goals
   - Work accomplished so far
   - Work to be accomplished (clear plans)

   *Note that the due date for your final project report is December 11, 2011. Submit this report as a word (`.docx`) or PDF (`.pdf`) file.*

   **Do check with me that I can view the figures OK — in some cases, I'm unable to see the lines in your PDF drawing. I'll be sending an email on Dec 12, 2011 in case I'm unable to view your documents. You must respond back the same day to discuss the matter.**

   Submit answers to Questions 2 through 8 as a single PDF named **asg10answers.pdf**, numbering your answers the same as these questions. You can typeset, or scan a hand-written copy.

2. **(15 points)** Applying the Schröder-Bernstein (SB), show that the number of points in a 3-dimensional grid over $Nat$,
$$3dGrid = \{\langle x, y, z\rangle \ \mid \ x, y, z \in Nat\}$$
is the same as those in a 2-dimensional grid over $Nat$,
$$2dGrid = \{\langle x, y\rangle \ \mid \ x, y \in Nat\}.$$
Here of course, $Nat = \{0, 1, 2, \ldots\}$.

3. **(20 points)** Using the SB-theorem, present a way to count regular expressions over the alphabet $\{a, b\}$, expressing your answer as a cardinal number.

4. **(20 points)** What is the cardinality of $A_{CFG}$? Prove your result using the SB theorem. Hint: find a way to map $\langle G, w\rangle$ into $Nat$; then find a way to map $Nat$ into $\langle G, w\rangle$ pairs using a numeric-order enumeration.
$$A_{CFG} = \{\langle G, w\rangle \ \mid \ G \textit{ is a } CFG \textit{ and } w \textit{ is a string in the language of } G\}$$

5. **(10 points)** Show that $INFINITE_{DFA}$ is a decidable language.

6. **(10 points)** Show that $NOODD_{DFA}$ is decidable.

7. **(10 points)** Show that $A_{CFG}$ is decidable.

8. **(10 points)** Describe the working of an enumerator TM for $NEQ_{CFG}$ in bulletted steps.