MA/CSSE 474 Summer 2014 midterm exam specification (Last updated July 18, 2014)

Resources allowed:

1. Required: Working Windows or Mac laptop with webcam and microphone. You will be instructed by ProctorU to download and install some software, so be sure that you have administrative rights to the computer you are using. A mirror or other flat, shiny surface (such as a CD) so you can show the proctor your surroundings
2. Two pieces of blank paper for use as scratch paper.
3. An empty bladder. The proctor will require that you stay within the webcam's view form the time you begin until the time you finally submit the exam.

ProctorU: http://www.rose-hulman.edu/class/csse/csse473/201440/Resources/ProctorU-and-summer-2014-classes.pdf . This service is required, and it is free if you sign up for an exam time at least 72 hours before that time, and if you don't miss your appointment. You must begin between midnight and 10 PM Indiana time on Monday, July 21.

Material Covered:
- **HW 0 - HW 9** (including the "not to turn in" problems)
- **Assigned readings** Sections A.1-A.6, 2.1-2.2, 3.1-3.2, 4.1-4.3, 5.1-5.8, 6.1-6.4, 8.1-8.6, 9.1-9.2, 10, 11.1-11.3 Chapters 1-5 from the textbook as well as documents posted on Moodle that are listed on the Schedule page for Sessions 1-16), and material from PowerPoint slides for sessions 1-21.

Question types: In order to minimize the amount of typing you must do, the exam will have severa short-answer, l multiple-choice and T-F-IDK questions. For questions where you have to write something, you do not have to have perfectly formatted mathematics. English and "mathematical pseudocode" is fine. For example, $Ex>0 (Ay \leq x^2)(x^2 + y^2 \geq 8)$ or
"empty set L = "empty set"

T-F-IDK. Below you will find several statements. A statement is true (T) if it is always true. It is false (F) if there is at least one counterexample (sometimes false). You may also choose IDK to indicate that you do not know the answer. *There is some value (to me and you) in knowing what you don't know.*
    Point values: Correct answer: 4, incorrect answer: -1, IDK: 1, blank: 0. So if you get seven questions correct, choose IDK for three, get two wrong, and leave one blank, your score is $7*4 + 3*2 - 2*1 + 1*0 = 32$ out of 52. What if you are not sure of an answer? If you are totally guessing an answer, you are probably better off pointwise if you choose IDK. If you have a feeling that one "real" answer is correct, you are probably better off guessing that answer.

Do you know how to use this algorithm/construction that we studied? Some questions will be checking to see whether you know and understand the details of specific algorithms or constructions. **Some examples**
- NDFSM → DFSM algorithm
- Minimal DFSM for a language or machine
- Find canonical form for a DFSM
- Construct machines to reverse, intersection, union, etc.
- Reg exp → FSM
- FSM → Reg exp

Decision algorithms:

- decideFSM
- decideRegExp
- emptyFSM
- totalFSM
- finiteFSM

- infiniteFSM
- equalFSMs
- minimalFSM

Concepts, definitions, etc.
- Propositional logic
- First-order logic (term, wff, quantifiers, free variable, sentence, interpretation, model, valid, satisfiable, unsatisfiable, theorem, proof, sound, complete
- Sets (enumeration, characteristic function, decide, partition, Cartesian product)
- Relations(binary, n-ary, inverse of a binary relation, reflexive, symmetric, transitive, equivalence relation, equivalence classes, partial order)
- Functions (total, partial, one-to-one, onto)
- Closure (relation R closed under property P, relation R closed under function f)
- Proof techniques (construction, contradiction, counterexample, case enumeration, mathematical induction, pigeonhole principle, Diagonalization.
- String (alphabet, length, replication, concatenation, reverse, proper substring, prefix, suffix)
- Language ({ } vs { ϵ }, lexicographic enumeration, uncountably infinite number of languages, functions on languages, concatenation, , reverseKleene * and +)
- Relationship between probles and languages
- Decision procedures
- Determinism and non-determinism
- Functions on languages (for example, chop, firstchars, oddsL, maxstring)
- Finite state machine (the five parts of the definition)
- Configuration, computation, acceptance of a string, rejection, language accepted by a DFSM, dead state.
- Regular languages
- Nondeterministic FSMs, acceptance, rejection, language accepted by M, ϵ-transitions
- $\approx_L$ equivalence classes for a language, distinguishable elements
- Regular expressions and the languages they describe
- Show a language regular or nonregular
- Closure properties
- Pumping Theorem
- Context-free grammars: terminal, nonterminal, productions (i.e. rules), derivation, language generated by a CFG