MA/CSSE 474 **Day 02 Summary**

Main ideas from today:

1. You should be able to quickly locate the course schedule page, the Moodle page, and the Piazza page. You should set the Piazza email option that best fits how you want to receive announcements and discussion posts. I recommend "real time"
2. For most students, this course will be very time-consuming. This is partly because you may need to read some sections of the textbook a few times before you "get it", and partly because some of the problems are very challenging.
3. This is a place to make notes about "policies and procedures" things that come out during our discussion.

4. More from yesterday's proof. There are two "long" versions online:
   - **a.** In yesterday's slides, with much of the focus on how the proof process works
   - **b.** A PDF file that has the proof with more details but less "process description", similar how I would write the proof if I were doing a 474 assignment.
5. The part of the proof that we did not do yesterday:
   - a. If *w* does not have two consecutive 1's. then *w* is accepted by M. We prove the contrapositive:
   - b. If *w* is not accepted by M, then *w* has two consecutive 1's.
   - c. No need for you to rewrite the proof from the slides, but here is a place to make notes about the proof.

6. Operations on strings:
   - a. $|w|$
   - b. $\#_a(w)$
   - c. Concatenation wx (it's associative, and ε is the identity for this operation)
   - d. w^i
   - e. w^R (recursive definition): $\varepsilon^R = \varepsilon$, $(ua)^R = au^R$

Theorem: If *w* and *x* are strings, then $(wx)^R = x^R w^R$. Prove it by induction on $|x|$

Base case: $|x| = 0$: Then $x = \varepsilon$, and $(wx)^R = (w\,\varepsilon)^R = (w)^R = \varepsilon\, w^R = \varepsilon^R\, w^R = x^R\, w^R$.

Induction step: $\forall n \geq 0\ (((|u| = n) \rightarrow ((w\,u)^R = u^R\, w^R)) \rightarrow ((|x| = n + 1) \rightarrow ((w\,x)^R = x^R\, w^R)))$:

Consider any string *x*, where $|x| = n + 1$. Then $x = u\,a$ for some symbol *a* and $|u| = n$. So:

$(w\,x)^R$	$= (w\,(u\,a))^R$	rewrite *x* as *ua*
	$= ((w\,u)\,a)^R$	associativity of concatenation
	$= a\,(w\,u)^R$	definition of reversal
	$= a\,(u^R\,w^R)$	induction hypothesis
	$= (a\,u^R)\,w^R$	associativity of concatenation
	$= (ua)^R\,w^R$	definition of reversal
	$= x^R\,w^R$	rewrite *ua* as *x*

7. ***If there is time:*** *prefixes and suffixes of strings, concatenation and powers of languages.*