Final Exam Topics, MATH 453 Spring 2008, Pelsmajer

Midterm exam topics

The Exponential formula
Section 3 of Wilf; Cards, Decks, & Hands
HW assigned March 11

Inclusion-Exclusion (P.I.E.)
HW assigned March 14

Permutations & Counting w/Symmetry
Different permutation notations: (two rows, one row, cycles)
Permutation Group
Cycle structure
Orbit Counting and Orbit OGF:
via Burnside's Lemma, and via Polya-Redfield-Frobenius Theorem for "colored objects"
Symmetries of Rigid objects and Graphs, including Cyclic Group & Dihedral Group...
...and induced symmetries of edges and faces (instead of vertices)
Orbit OGF plus substitution, for counting & other OGFs

Design Theory
The key issue for you is perhaps:

Operating in an environment where some things are *hard* and some are *still unknown.* In both cases, you cannot hope to come up with an ad hoc proof during the exams; you must remember and apply a theorem to answer the question, and you must avoid (incorrectly) using theorems that don't apply to the situation. On the other hand some things *can be done by basic proof techniques* (mostly counting something two ways), and these proofs you should be able to (re)produce on the spot.

Latin Squares
existence of k MOLS(n) for various k including $k = 2$, and $k = n - 1$ (complete MOLS)
k MOLS(n) $\leftrightarrow$ OA($k + 2, n$)
Steiner Triple Systems
Theorem: A STS(n) exists if and only if...
basic proofs (but not the big proof)
(b, v, r, k, λ)-designs
trivial designs
"basics" & Fisher's Inequality
Symmetric Designs
Projective plane
various properties
Projective Plane of order $q \Leftrightarrow (q^2 + q + 1, q^2 + q + 1, q + 1, q + 1, 1)$-design $\Leftrightarrow$ complete MOLS(q)