Math 22 Final Exam study guide Winter 2009

20 multiple choice questions
5 "show your work" questions

Multiple choice questions, use brown half-page scantron for answers:

(1) Calculation of number of elements of small sets, involving intersection, union, complement
(2) Permutation calculation
(3) Combination calculation
(4) Ordered arrangements with repetition – for example, how many ways are there to arrange the letters BARACKOBAMA?
(5) Generating function question – for example, if 15 identical candy bars are distributed to Alice, Bob, Carol, and Dave, and if Alice and Bob must each receive at least one, and Carol and Dave must each receive at least 2, then write a generating function showing how many ways are there to do this. See hint at bottom of this handout.
(6) Unordered selection with repetition (for example, problem in #5)
(7) Graph isomorphism, graph complement
(8) Hamiltonian cycle and Euler circuit. Like problem on one of the exams.
(9) Binomial theorem expansion. Know how to expand a binomial!
(10) Calculation with binomial coefficients. Like problem 2 on exam 1.
(11) Universal/existential quantifier problem
(12) Truth table problem. Like on exam 2.
(13) Prufer code problem
(14) Minimal or maximal spanning tree problem
(15) Coloring number problem. Do you know the coloring numbers of some common kinds of graphs?
(16) One-to-one and onto functions. Like problem 3 on exam 1.
(17) Matrix code problem. Like on exam 2.
(18) Binary tree traversal
(19) Linear recursion
(20) Adjacency matrix problem

Show your work problems:

(21) Solve a linear congruence. Like on exam 2.
(22) RSA code problem. Like on exam 2.
(23) Express a GCD as linear combination, using the Euclidean algorithm.
(24) Pigeonhole principle.
(25) Induction proof.

(5) Imagine that the As are all different, as in A_i, as well as the two Bs:

There are 11! ways to arrange the letters $B_1\ A_1R\ A_2CKO\ B_2\ A_3M\ A_4$
But we have to divide by the number of ways, 2! And 4!, to order the individual Bs and As, so total number of ordered arrangements is $\frac{11!}{2!4!}$.

(6) Generating function is

$$(x + x^2 + x^3 + \ldots)(x + x^2 + x^3 + \ldots)(x^2 + x^3 + x^4 \ldots)(x^2 + x^3 + x^4 \ldots)$$

Alice *Bob* *Carol* *Dave*

… since Alice and Bob must have at least 1, Carol and Dave at least 2, etc.
(Note that this can be simplified!)