

Some problems to study for final exam Math 22, Spring 2012
(These are not necessarily all!)

- (1) Solve a linear congruence and tell how many solutions in the original modulus
- (2) Use modular arithmetic correctly
- (3) Be able to tell whether a graph has a Hamiltonian cycle or an Euler circuit
- (4) Know how to use binary matrix codes to check for and detect errors.
- (5) Understand basics of error-correcting and error detecting codes.
- (6) Be able to find the chromatic number of a graph.
- (7) Be able to draw a graph with a given degree sequence.
- (8) Be able to represent a graph with a matrix and know how to use powers of the adjacency matrix to find numbers of paths between vertices.
- (9) Be able to decide whether two graphs are isomorphic.
- (10) Find the shortest path from one vertex to another in a weighted graph.
- (11) Understand the use of logical connectives, and be able to build the truth table for a logical statement
- (12) Understand the difference between a statement, its converse, its inverse, and its contrapositive.
- (13) Be able to give a simple proof by contradiction.
- (14) Use Euler's formula, use its corollaries to decide whether a graph is non-planar.
- (15) Use Prufer's code for a given labeled tree, or recreate the tree from the code.
- (16) Use Kruskal's or Prim's algorithm to find a minimal spanning tree for a graph.
- (17) Prove a statement by induction.
- (18) Decide whether a mathematical relation is an equivalence relation.
- (19) Set up a generating function to solve a counting problem
- (20) Use the Principle of Inclusion/Exclusion
- (21) Use the pigeonhole principle.
- (22) Solve a recurrence relation using the characteristic equation.
- (23) Find the chromatic number of a graph.

Universe = $\{1,2,3,\dots,10\}$

Let $A = \{x \text{ congruent to } 1, \text{ mod } 4\}$, $B = \{a,b\}$.

Find the

- (1) # of functions from A to B.
- (2) # of functions from B to A.
- (3) # of 1 to 1 functions from A to B.
- (4) # of 1 to 1 functions from B to A.
- (5) # of onto functions from A to B.
- (6) # of onto functions from B to A.
- (7) # of equivalence relations on $A \times A$.
- (8) # of subsets of $A \cup B$ with 3 elements.
- (9) # of ordered arrangements of $A \cup B$ with 3 elements.
- (10) # of functions $f: A \cup B \rightarrow \{1,2,3,\dots,10\}$ which have $f(1)+f(5)+f(9)+f(a)+f(b) = 5$.
- (11) Expand $(3 - 4x^2)^5$
- (12) Expand $(1 - 4x^2)^{-3}$ and show the first five terms.
- (13) # of strings from $A \cup B$ of length 5 using exactly 3 symbols of $A \cup B$.