Final Exam on

MACM-101 Discrete Mathematics (SAMPLE)

1. What is an open variable?
2. Prove that sets A and B are disjoint if and only if $A \cup B = A \Delta B$.
3. Prove that the relation $a \equiv b \pmod{m}$ is an equivalence relation on the set of integers.
4. If $f \circ g$ is one-to-one, does it follow that g is one-to-one?
5. What does it mean that a set is not countable?
6. Prove that for every positive integer n

$$1 \cdot 2^1 + 2 \cdot 2^2 + 3 \cdot 2^3 + \ldots + n \cdot 2^n = (n-1)2^{n+1} + 2.$$

7. How many ways are there to choose a dozen donuts from the 21 varieties at a donut shop?
8. State Pascal's identity.
9. What is the probability that a five-card poker hand contains a straight, that is, five cards that have consecutive kinds? (Note that an ace can be considered either the lowest card of an A-2-3-4-5 straight or the highest card of a 10-J-Q-K-A straight.)
10. State the generalized pigeonhole principle.
11. State and prove the Chinese Remainder Theorem.
12. Give a definition of an inverse of a number a modulo m.
13. Determine the greatest common divisor of 2689 and 4001.