

Discrete Mathematics and Applications

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1 Assignment No. 4: sets and sequences

Due: Tuesday, 16 Oct.

Please submit your answer in a neat, readable properly organized format.

2 Sets

1. There 35 students in our class. How many teams can we have if no team is a subset of another team.
2. **(Sage)** Can you find an integer n such that:
 $n^2 \bmod 113 = 77$, $n^3 \bmod 233 = 34$, and $n^3 + n^2 \bmod 173 = 172$

2.1 Functions

1. In the enumeration used in class for $N \times N$ in what location will be the pair $(100, 50)$.
What pair will be in location 2011?
2. a. If f and $f \circ g$ are ONTO does it follow that g is ONTO?
b. If f and $f \circ g$ are 1-1 does it follow that g is 1-1?
3. Show that the function $f : Z^+ \times Z^+ \rightarrow Z^+$ defined by: $\frac{(m+n-2)(m+n-1)}{2} + m$ is a bijection.
4. **(Sage)** How many 1's are in the binary representation of 50! (fifty factorial).

2.2 Sequences

For the following sequences try to identify a rule and the next two terms in the sequence.

1. 3, 5, 8, 12, 17, 23, ...
2. 2, 2, 3, 5, 5, 7, 7, 11, 11, 11, 11, 13, 13, 17, 17, 17, 17, ...
3. * Let a_n denote the n^{th} term of the sequence 1, 2, 2, 3, 3, 3, 4, 4, 4, 4, 5, 5, 5, 5, 6, ...
Prove that $a_n = \lfloor \sqrt{2n} + \frac{1}{2} \rfloor$.