Theoretical Foundations of Computer Science (Test 2)

Time: 1 hr 15 min Marks: 30

Questions:

1. If every element of a group G is its own inverse, show that G is abelian. 5 marks
2. Let G be a group of even order. Prove that there must be an element $a \neq e$ in G such that $a^2 = e$. 5 marks
3. Prove that the product of all non-zero elements of $\mathbb{F}_p$ is -1. 5 marks
4. Prove that the set of real $n \times n$ matrices is a vector space. Which of the following are its subspaces and why? 8 marks
   (a) Symmetric matrices ($A = A^T$)
   (b) Invertible matrices
   (c) Upper triangular matrices
5. **Sterling numbers of second kind:** Find the number of ways of distributing n distinguishable balls into k indistinguishable bins with no bin empty. 7 marks

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