Sample questions

1. How many integral solutions of

$$x_1+x_2+x_3+x_4 = 30$$

Satisfy $x_1 \geq 2$, $x_2 \geq 0$, $x_3 \geq -5$, and $x_4 \geq 8$.

2. How many ways are there to colour the vertices of the 5-cycle so that adjacent vertices receive different colours?

3. Let $A(X) = \sum_{n=0}^{\infty} a_n X^n$, where a_n=3a_{n-1}-2a_{n-2}+2, and a_0=a_1=1. Write $A(X)$ as the quotient of two polynomials.

4. Show that every automorphism of a tree must fix a vertex or an edge.

5. Show that there are at most 5 connected simple planar graphs in which every face has the same degree ϕ and every vertex has the same degree $\delta > 2$.

6. For a given graph G show that the chromatic number $\chi(G)$ is less than or equal to the maximum degree $\Delta(G)$.

7. Construct a cyclic Steiner Triple system of order 13.

8. Construct 2 idempotent mutually orthogonal Latin squares of order 4.

9. Show that a transversal design on nk points with k groups is equivalent to k-2 mutually orthogonal Latin squares of order n.