1) Let $G$ and $H$ be the indicated graphs.
   1A) Prove $G$ and $H$ are not isomorphic.
   1B) Find $\tau(G)$ and $\tau(H)$.
   1C) Find $\chi(G;k)$ and $\chi(H;k)$.

2) Find the maximal flow in the network at left.
   Indicate the minimal cut that validates your answer.

3) Given 6 messages with relative frequencies 1,3,4,6,7,9, compute a code with minimum expected length, and what is the expected length of a message in this optimal code?

4A) IF $G$ is a planar connected graph, prove or display a counter example to the following statement: $\chi'(G) = \chi'(G^*)$.
   4B) Let $G = K_{r,s}$ ($r \geq s$). Prove (by finding an explicit coloring) $\chi'(G) = \Delta(G)$.

5) Prove that $G$ has a Hamiltonian path ONLY IF for every set $S$ of $p$ vertices of $G$, the number of components of $G - S$ is at most $p + 1$.

6) Let $C$ and $C'$ be cycles in a graph $G$. Prove that the symmetric difference $C \Delta C'$ decomposes into cycles.

7) Let $G$ be a $k$-connected graph and let $S$ and $T$ be disjoint subsets of $V(G)$ of size at least $k$. Prove $G$ contains $k$ pairwise disjoint $S,T$-paths.