1. (2 marks) If α is a positive real number, then prove that $(\log x)^{\alpha} = O(x)$.

2. (2 marks) If a relation on a set is symmetric and transitive, then is it also reflexive? Prove the statement or give a counterexample.

3. (2 marks) Determine the number of equivalence relations on the set $\{1, 2, 3, 4\}$ which contain precisely 3 distinct equivalence classes.

4. (2 marks) Let $s(n) = \sum_{i=1}^{n} \log i$, where log denotes the natural logarithm. Give a big theta estimate for $s(n)$ (your estimate should not contain a summation sign).

5. (2 marks) Consider the set $A = \{1, 2\}$. There are precisely three binary relations on A that are not transitive. List these three relations.