

4. Define r -combinations. Give a formula for the number of r -combinations from a set with n elements. [10]
5. State the generalized pigeonhole principle. [12]
6. Verify if the given conclusion can be drawn from the given premisses. Explain which rules of inference are used for each step.
“All movies produced by John Sayles are wonderful. All wonderful movies are about coal miners. Therefore, all movies produced by John Sayles are about coal miners.” [12]

7. Define the Kleene star of a formal language. [10]

8. Determine the truth value of the following statement if the universe of each variable consists of all natural numbers. Explain. [12]

$$\forall x \forall y \exists z (x + y < z).$$