THE UNIVERSITY OF QUEENSLAND
Department of Mathematics
MATH1061: Discrete Mathematics Second Exam
October 2002
Exam Time: 50 minutes; Perusal Time: 5 minutes.

Question 1. By mathematical induction prove

\[ \sum_{i=1}^{n+1} i \cdot 2^i = n \cdot 2^{n+2} + 2, \] for all integers \( n \geq 0. \)

(5 marks)

Question 2. By mathematical induction prove

\[ 1^3 + 2^3 + 3^3 + \ldots + n^3 = \frac{n^2(n + 1)^2}{4}, \] for all integers \( n \geq 1. \)

(5 marks)

Question 3. Let \( A = \{1, 2\} \) and \( B = \{2, 3\}. \) Find the elements of \( \mathcal{P}(A \times B). \) (Hint: First you need to find \( A \times B. \))

(5 marks)

Question 4. Use Venn diagrams to show that

\[ (A \setminus B) \cup (B \setminus A) = (A \cup B) \setminus (A \cap B). \]

(3 marks)