

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

$$\sum_{i=1}^{n+1} i \cdot 2^i = n \cdot 2^{n+2} + 2, \quad \text{for all integers } n \geq 0.$$

(5 marks)

Question 2. By mathematical induction prove

$$1^3 + 2^3 + 3^3 + \dots + n^3 = \frac{n^2(n+1)^2}{4}, \quad \text{for all integers } n \geq 1.$$

(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)