



Module Code MA4001: Logic & Problem Solving

Tutorial: Week 6

Duration: 1 hour

1. Using set listing notation write down the power sets, $P(A)$, when:
 - i) $A = \{a\}$
 - ii) $A = \{a, b, c, d\}$
2. Let $A = \{a, b, c, d\}$ and $B = A \cup \{e\} = \{a, b, c, d, e\}$.
 - i) How many subsets of B are there which do not have e as an element?
 - ii) How many subsets of B do have e as an element?
 Deduce the value of $|P(B)|$.
3. By considering the results for $n = 1, 2, 3, 4$ and 5 , try and guess a formula for $|P(A)|$ when $|A| = n$ where $n \in \mathbb{Z}^+$
 Hence write down $|P(A)|$ when $A = \{x : x \in \mathbb{Z}^+, x < 9\}$.
4. Write down $P(\emptyset)$, the power set of the empty set. How does your answer relate to your formula in question 3?
5. Since $P(A)$ is a set, we can form $P(P(A))$. Write down $P(P(A))$ in set listing notation when:
 - i) $A = \{2\}$
 - ii) $A = \{a, b\}$
6. Let $A = \{1, 2, 3\}$ and $B = \{a, b\}$.
 Write down the following sets in set listing notation:
 i) $A \times B$ ii) $B \times A$ iii) $A \times A$ iv) $B \times B$
 State the values of $|A \times B|$, $|B \times A|$, $|A \times A|$ and $|B \times B|$
 Using your answers and those from examples 1.26 and 1.27, guess a formula for $|A \times B|$ when $|A| = n$ and $|B| = m$, where $n, m \in \mathbb{Z}^+$.
7. Suppose A is a set with n elements. Write down $A \times \emptyset$
 How does your answer relate to your formula in question 6?
8. Let $A = \{x : x = 2k, k \in \mathbb{N}\}$ and $B = \{x : x = 2k + 1, k \in \mathbb{N}\}$.
 Does the set $\{A, B\}$ form a partition of the following?
 i) \mathbb{Z} ii) \mathbb{Z}^+ iii) \mathbb{N}
9. Let $A = \{x : x \in \mathbb{N}, x \leq 10\}$, $B_1 = \{x : x = 3k + 1, k \in \mathbb{N}, k < 4\}$ and $B_2 = \{2, 5, 9\}$.
 Find the set B_3 if $\{B_1, B_2, B_3\}$ forms a partition of A .

10. Let $A = \{1,2,3,4,5,6,7\}$ and let $A_1 = \{1,2,3\}$, $A_2 = \{3,6,7\}$, $A_3 = \{4,7\}$, $A_4 = \{5,1,4\}$, $A_5 = \{5,6\}$ and $A_6 = \{2\}$.

Which of the following are partitions of A ?

- i) $\{A_1, A_2, A_3\}$
- ii) $\{A_1, A_3, A_5\}$
- iii) $\{A_6, A_2, A_4\}$
- iv) $\{A_4, A_2, A_1\}$

11. List all the partitions of $A = \{1,2,3\}$.

12. 100 people were asked if they liked Math, Science, or Social Studies. Everyone answered that they liked at least one.

56 like Math

43 like Science

35 like Social Studies

18 like Math and Science

10 like Science and Social Studies

12 like Math and Social Studies

6 like all three subjects

Use the above information to draw the Venn diagram and answer the following questions,

- a) How many people like Math only?
- b) How many people like Science only?
- c) How many people like Social Studies only?

END OF TUTORIAL