1) Show that
(a) $\overline{A \cup B} \cup \overline{A \cup B} = A$
(b) $(A \cup B)(\overline{A} \overline{B}) = A\overline{B} \cup B\overline{A}$
(c) $\overline{A} \cap (B \cup C) = (\overline{A} \cup B) \cap (\overline{A} \cup C)$

2) Let $\{A_1, ..., A_n\}$ be a partition of the space $S$ and define the family of sets $\{B_1, ..., B_n\}$

$$B_j = G \cap A_j, \quad j = 1, ..., n$$

where $G \subseteq S$. Show that $\{B_1, ..., B_n\}$ is a partition of the set $G$.

3) Prove that a finite set with $n$ elements has $2^n$ distinct subsets.

4) Show that
(a) If $P(A) = P(B) = P(AB)$, then $P(A\overline{B} \cup B\overline{A}) = 0$.
(b) If $P(A) = P(B) = 1$, then $P(AB) = 1$.

5) If $S = \{a, b, c, d, e\}$, find the smallest field that contains the sets $\{b\}$ and $\{a, d, e\}$.

6) A bus comes to a bus stop at time $t$, where $t$ is a random point in the interval $(10,15)$.

(a) Find $P\{8 \leq t \leq 12\}$.
(b) Find $P\{8 \leq t \leq 12|t > 10\}$.

7) A player tosses a penny from a distance onto the surface of a square table ruled in 1 cm squares. If the penny is $\frac{3}{4}$ cm in diameter, what is the probability that it will fall entirely inside a square (assuming that the penny lands on the table).

8) A box contains $m$ white and $n$ black balls. Suppose $k$ balls are drawn. Find the probability of drawing at least one white ball.

9) The university buys workstations from two different suppliers, Mini Micros (MM) and Highest Technology (HT). On delivery, 10% of MM’s workstations are defective, while 20% of HT’s workstations are defective. The university buys 140 MM workstations and 60 HT workstations for its computer lab. Suppose you walk into the computer lab and randomly sit down at a workstation.

(a) What is the probability that your workstation is from MM? From HT?
(b) What is the probability that your workstation is defective?
(c) Given that your workstation is defective, what is the probability that it came from Mini Micros?

10) We have two coins; the first is fair and the second two-headed. We pick one of the coins at random, we toss it twice and heads shows both times. Find the probability that the coin picked is fair.

11) The probability that a cell in a wireless system is overloaded is $1/3$. Given that it is overloaded, the probability of a blocked call is 0.3. Given that it is not overloaded, the probability of a blocked call is 0.1. Find the conditional probability that the system is overloaded given that your call is blocked.