

NANYANG TECHNOLOGICAL UNIVERSITY
School of Electrical & Electronic Engineering

EE4491 Probability Theory & Applications

Tutorial No. 1 (Sem 1, AY2021-2022)

1. A company manufactures small electric motors having horsepower ratings of 0.1, 0.5 or 1.0 horsepower (hp) and designed for operation with 120 V single-phase (1- ϕ) ac, 240 V 1- ϕ ac and 240 V three-phase (3- ϕ) ac. The motor types can be distinguished only by their nameplates. A distributor has on hand 3000 motors in the quantities shown in the table below:

| Horsepower | 120 V 1-ϕ ac | 240 V 1-ϕ ac | 240 V 3-ϕ ac |
|-------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| 0.1 | 900 | 400 | 0 |
| 0.5 | 200 | 500 | 100 |
| 1.0 | 100 | 200 | 600 |

One motor is discovered without a nameplate. For this motor determine the probability of each of the following events:

- (a) The motor has a horsepower rating of 0.5 hp.
(b) The motor is designed for 240 V single-phase operation.
(c) The motor is 1.0 hp and is designed for 240 V three-phase operation.
(d) The motor is 0.1 hp and is designed for 120 V single-phase operation.
2. A space S is defined as
 $S = \{1, 3, 5, 7, 9, 11\}$
The three subsets are
 $A = \{1, 3, 5\}$, $B = \{1, 5, 7, 9, 11\}$, $C = \{1, 3, 9, 11\}$
(a) Find $A \cap B \cap C$.
(b) Determine $\bar{A} \cap B$.
(c) List the elements of $(A - B) \cup C$.
3. Use the Venn diagram to show that $\overline{(A \cup B)} = \bar{A} \cap \bar{B}$.
4. Use the axioms of probability to show that
 $\Pr(A \cup B) = \Pr(A) + \Pr(B) - \Pr(A \cap B)$

Answer

- (1) (a) 4/15; (b) 11/30; (c) 1/5; (d) 3/10
(2) (a) {1}; (b) {7, 9, 11}; (c) {1, 3, 9, 11}