

NATIONAL UNIVERSITY OF SINGAPORE
DEPARTMENT OF STATISTICS & DATA SCIENCE
ST2334 PROBABILITY AND STATISTICS
SEMESTER I, AY 2025/2026

Tutorial 02

Please work on the questions before attending the tutorial.

Exam-Like Questions

1. MULTIPLE CHOICE: CHOOSE ONE ANSWER ONLY

Let A and B be events so that $P(A \cup B) = P(A) + P(B)$. Which of the following is **NOT** true?

- (a) If A and B are independent, then $P(A) = 0$ or $P(B) = 0$.
- (b) If $A \neq B$, then A and B are mutually exclusive.
- (c) If $P(A) > P(B) > 0$, then A and B are not independent.
- (d) If $A = S$, the sample space, then $P(B) = 0$.

2. MULTIPLE CHOICE: CHOOSE ONE ANSWER ONLY

Draw 4 balls randomly without replacement from a basket containing 4 blue balls, 4 green balls, and 2 red balls. What is the probability to get 2 blue balls, 1 green ball, and 1 red ball?

- (a) $7/105$
- (b) $8/105$
- (c) $9/35$
- (d) $8/35$

3. MULTIPLE CHOICE: CHOOSE ONE ANSWER ONLY

The probability that a Singaporean company will set up a factory in City A is 0.7. The probability that it will set up a factory in City B is 0.4, and the probability that it will set up factory in either City A or City B or both is 0.8. Which of the following statements is **INCORRECT**?

- (a) The probability that the company will set up factories in both cities is 0.3.
- (b) The probability that the company will set up factory in neither city is 0.2.
- (c) Whether the company will set up a factory in City A is independent of if will set up a factory in City B.
- (d) Whether the company will set up a factory in City B is not independent of if it will set up a factory in City A.

4. MULTIPLE CHOICE: CHOOSE ONE ANSWER ONLY

A worker needs to drive to work from his home daily. There is only one route available, on which there are two speeding cameras working independently. The speeding cameras at each of these two different locations operates 50% and 75% of the time respectively. Based on the worker's driving habit, he will speed 40% of the time; and whether he will speed at different time points are independent. What is the probability that the worker will not receive a speeding ticket on any given day?

Note:

We assume that whether a camera is working at any time is independent of whether a driver is speeding, when s/he drives through any camera.

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| (a) 0.56 | (c) 0.36 |
| (b) 0.48 | (d) 0.72 |

5. **FILL IN THE BLANK**

Consider 5-card poker hands dealt from a standard 52 card deck. Two important events are

$$A = \{\text{You draw a flush}\}, \quad B = \{\text{You draw a straight}\}.$$

- A flush means that you have 5 cards from the same suit.
- A straight means that the 5 cards are in numerical order, e.g., 9 of diamonds, 10 of hearts, jack of hearts, queen of spades and king of spades.
- We assume that the ace can come before 2, or after the king.
- A straight flush, i.e., 5 consecutive cards of the same suit, is not a straight.

If you are dealt a 5-card hand, find the following probabilities:

- (a) $P(A) = \underline{\hspace{2cm}}$
 (b) $P(B) = \underline{\hspace{2cm}}$

Long Form Questions

1. Suppose there are 500 applicants for five *equivalent* positions at a factory. The company is able to narrow the field to 30 equally qualified applicants. Seven of the finalists are minority candidates. Assume that the five who are chosen are selected at random from this final group of thirty.
 - (a) In how many ways can the selection be made?
 - (b) What is the probability that none of the minority candidates are hired?
 - (c) What is the probability that no more than one minority candidate is hired?
2. There are two intersections with traffic lights along the route taken by a motorist driving to work. The probability that he must stop at the first light is 0.4, the probability that he must stop at the second light is 0.5, and the probability that he must stop at at least one of the two lights is 0.6. What is the probability that he must stop
 - (a) at both lights?
 - (b) at exactly one light?
 - (c) at neither light?
 - (d) at the second light given that he has stopped at the first light?

Is the event “stopping at the first traffic light” independent of the event “stopping at the second traffic light”?
3. A soft-drink bottling company maintains records concerning the number of unacceptable bottles of soft drink obtained from the filling and capping machines. Based on the past data, the probability that a bottle came from machine I and was nonconforming is 0.01, and the probability that a bottle came from machine II and was nonconforming is 0.025. Half the bottles are filled on machine I and the other half are filled on machine II. If a filled bottle of soft drink is selected at random, what is the probability that
 - (a) it is a nonconforming bottle?
 - (b) it was filled on machine II?

- (c) it was filled on machine II and is a conforming bottle?
- (d) It was filled on machine I or is a conforming bottle?
- (e) Suppose you know that the bottle was produced on machine I. What is the probability that it is nonconforming?
- (f) Suppose you know that the bottle is nonconforming. What is the probability that it was produced on machine I?

Explain the difference in the answers to (3e) and (3f).

Answers to some Long Form Questions

- 1. (a) 142506; (b) 0.2361; (c) 0.6711.
- 2. (a) 0.3; (b) 0.3; (c) 0.4; (d) 0.75. Not independent
- 3. (a) 0.035; (b) 0.5; (c) 0.475; (d) 0.975; (e) 0.02; (f) 0.2857.