

# Probability Exercise

Math 125 *Kovitz*

A box has five tickets, marked with the letters A, B, C, D, and E.



Two draws are made at random from this box.

1. Find the chance of getting the D on the first draw and the E on the second draw if the draws are made:
  - (a) with replacement.
  - (b) without replacement.
2. Find the chance of getting at least one D in the two draws if the draws are made:
  - (a) with replacement.
  - (b) without replacement.
    - i. True or false: The results ‘getting the D on the first draw’ and ‘getting the D on the second draw’ are mutually exclusive because the draws are made without replacement.
    - ii. True or false: If two events P and Q are mutually exclusive, the probability of at least one of P and Q happening equals the sum of their chances:
$$P(P \text{ or } Q) = P(P) + P(Q).$$
    - iii. The chance of getting the D at least once in the two draws is (choose one answer and explanation):

A.  $1/5 + 1/5 = 20\% + 20\% = 40\%.$

Add the probabilities: 20% that the D is chosen on the first draw and 20% (1 out of 5) that the D is chosen on the second draw. This requires the unconditional chance that the D will be chosen on the second draw. Do not make the mistake of assuming that a blank has already been drawn; that would be a conditional chance and is not what is called for in the addition rule.

B.  $1/5 + 1/4 = 20\% + 25\% = 45\%.$

Add the probabilities: 20% that the D is chosen on the first draw and 25% (1 out of 4) that the D is chosen on the second draw. The D can only be drawn second if a blank ticket was drawn first.

C.  $1 - (4/5)(4/5) = 1 - 16/25 = 9/25 = 36\%.$

Find the chance of the opposite event:  $4/5 \times 4/5$ , which equals 16/25 or 64%. Then subtract that from 100% to get 36%.

D.  $1 - (4/5)(3/4) = 1 - 12/20 = 8/20 = 40\%.$

Find the chance of the opposite event: not getting a D on the first draw and not getting a D on the second draw (using conditional probabilities):  $4/5 \times 3/4 = 12/20 = 60\%$ . Then subtract that from 100% to get 40%.

## Reprise:

For each part (1a, 1b, 2a and 2b): State which you initially checked for: independence or mutual exclusivity; state the answer: “yes” or “no”; name the formula or method that was used; and write out that formula or method.

### Formulas:

- i) The multiplication rule.
- ii) The multiplication rule for independent events.
- iii) The addition rule.
- iv) The method of de Méré when A and B are not mutually exclusive but independent.

**Note:** part 2 (B) iii. has two different correct answers; either one of two formulas gives the desired probability.