

# IEB Probability and counting practice — Memorandum

Every answer below was confirmed by an independent verifier at the moment the question was made.

# The fundamental counting principle

1

**(a) Answer: 59049**

1.  $9 \times 9 \times 9 \times 9 \times 9$

2.  $= 59049$

---

**(b) Answer: 15120**

1.  $9 \times 8 \times 7 \times 6 \times 5$

2.  $= 15120$

---

**(c) Answer: 0.7439**

1.  $P(\text{nothing repeated}) = \frac{15120}{59049}$

2.  $P(\text{at least one repeated}) = 1 - \frac{15120}{59049} = 0.7439$

---

**(d) Answer: 14580**

1. first: 4 choices; last: 5 choices; the middle 3: 9 each

2.  $4 \times 9 \times 9 \times 9 \times 5 = 14580$

---

**(e) Answer: 2520**

1.  $7 \times 6 \times 5 \times 4 \times 3$

2.  $= 2520$

---

**(f) Answer: 360**

1. 1 vowels for the first letter, then  $6 \times 5 \times 4 \times 3$

2.  $1 \times 360 = 360$

2

**(a) Answer:** 1260

1. 7 letters, with L 2 times, O 2 times

2.  $7!/(2! \times 2!) = 1260$

---

**(b) Answer:**  $\frac{1}{21}$

1. fix A first and O last: 60 arrangements of the other 5 letters

2.  $P = \frac{60}{1260} = \frac{1}{21}$

---

**(c) Answer:** 120

1.  $5! = 120$

---

**(d) Answer:** 36

1. treat the 3 as one block: 3 units, 3! ways

2. the block itself in 3! ways

3.  $3! \times 3! = 36$

---

**(e) Answer:** 120

1.  $5 \times 4 \times 3 \times 2 \times 1$

2.  $= 120$

---

**(f) Answer:** 6

1. the first digit is at least 8, the last digit even

2. count each choice of first and last digit, then fill the middle

3.  $= 6$

# The probability rules

3

**(a) Answer: 0.85**

1. mutually exclusive:  $P(A \text{ and } B) = 0$

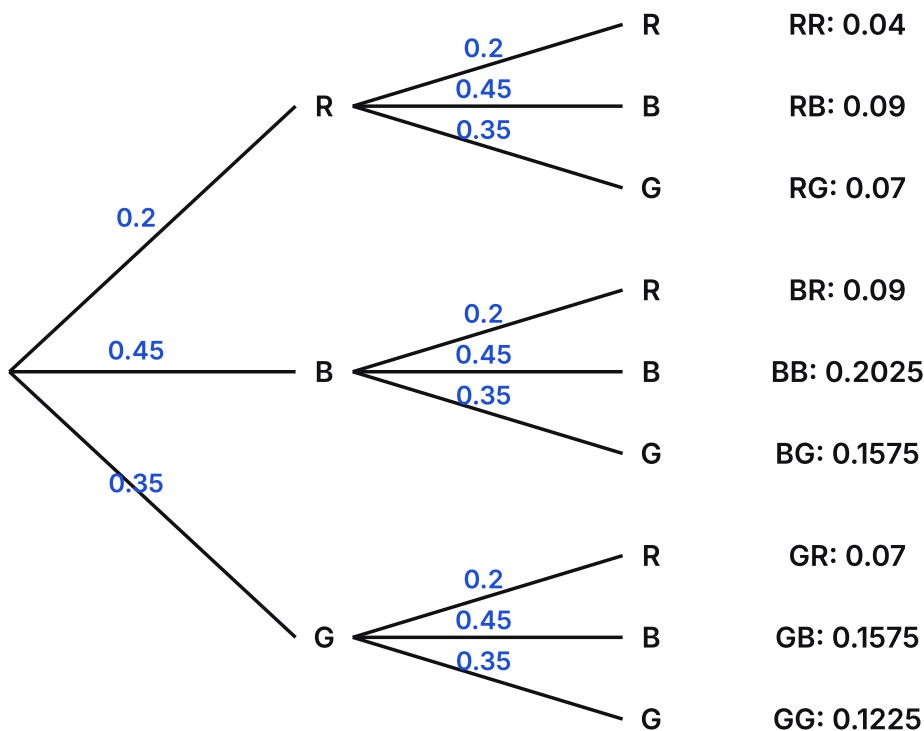
2.  $P(A \text{ or } B) = 0.45 + 0.4 = 0.85$

**(b) Answer: 0.67**

1. independent:  $P(A \text{ and } B) = 0.45 \times 0.4 = 0.18$

2.  $P(A \text{ or } B) = 0.45 + 0.4 - 0.18 = 0.67$

**(c) Answer:** See the tree below.



1. three branches for the first spin, three from each for the second

2. each outcome's probability is the product along its branches

**(d) Answer: 0.18**

1.  $P(RB) + P(BR) = 0.2 \times 0.45 + 0.45 \times 0.2$

2.  $= 0.18$

**(e) Answer:** 0.36

1.  $1 - P(\text{no red}) = 1 - (0.8)^2$

2.  $= 0.36$

**(f) Answer:**  $\frac{7}{12}$

1.  $n(\text{chess or drama}) = 21 + 9 - 2 = 28$

2.  $P = \frac{28}{48} = \frac{7}{12}$

**(g) Answer:** No, they are not independent

1.  $P(\text{chess}) \times P(\text{drama}) = \frac{7}{16} \times \frac{3}{16} = \frac{21}{256}$

2.  $P(\text{both}) = \frac{1}{24}$

3. not equal: not independent

4

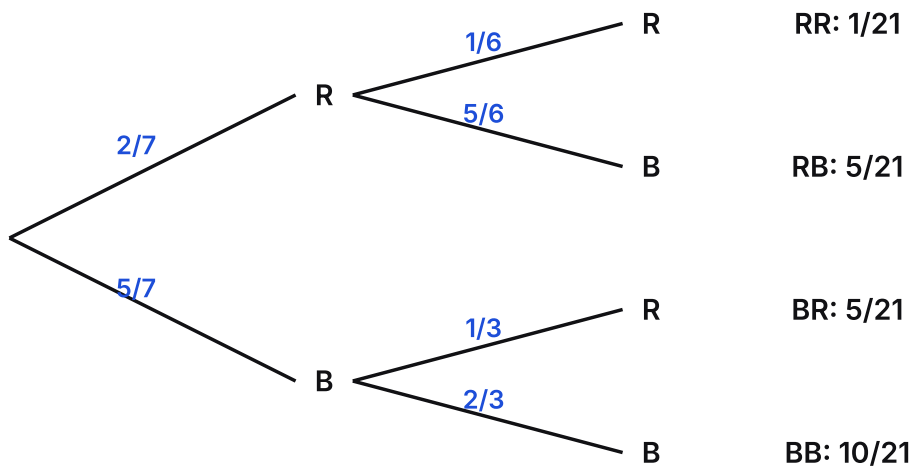
**(a) Answer:** 0.0825

1.  $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
2.  $P(A \text{ and } B) = 0.55 + 0.15 - 0.6175 = 0.0825$

**(b) Answer:** Not mutually exclusive, and independent

1.  $P(A \text{ and } B) = 0.0825 \neq 0$
2.  $P(A) \times P(B) = 0.55 \times 0.15 = 0.0825 = P(A \text{ and } B)$
3. not mutually exclusive, and independent

**(c) Answer:** See the tree below.



1. first draw: red  $\frac{2}{7}$ , blue  $\frac{5}{7}$
2. second draw: 6 balls are left, one fewer of the colour taken

**(d) Answer:**  $\frac{11}{21}$

1.  $P(RR) + P(BB) = \frac{1}{21} + \frac{10}{21}$
2.  $= \frac{11}{21}$

**(e) Answer:** 3

1.  $22 + 14 - x + 3 = 36$

$$2. x = 3$$

---

**(f) Answer:**  $\frac{5}{6}$

1. only History: 19; only Geography: 11

$$2. P = \frac{30}{36} = \frac{5}{6}$$