6. sample size $= pN$ with kind $\begin{cases} |A| = N \\ |B| = N \\ |C| = N \\ |D| = N \end{cases}$ $N \to \infty$ $\therefore$ equal probability

Green in A: $[1, 3, 5, 7, 9, 11, 13, 15]$

B: $[2, 4, 6, 8, 10, 12, 14, 16]$

C: $[9, 10, 11, 12, 13, 14, 15, 16]$

D: $[1, 2, 3, 4, 5, 6, 7, 8]$

Let the 5 tickets be t_1, t_2, t_3, t_4, t_5

The cases that 5 tickets with number i are all green:

i

1. $t_1, \dots, t_5 \in A \cap D$
2. $t_1, \dots, t_5 \in B \cap D$
3. $t_1, \dots, t_5 \in A \cap D$
4. $t_1, \dots, t_5 \in B \cap D$
5. $t_1, \dots, t_5 \in A \cap D$
6. $t_1, \dots, t_5 \in B \cap D$
7. $t_1, \dots, t_5 \in A \cap D$
8. $t_1, \dots, t_5 \in B \cap D$

i

9. $t_1, \dots, t_5 \in A \cap C$
10. $t_1, \dots, t_5 \in B \cap C$
11. $t_1, \dots, t_5 \in A \cap C$
12. $t_1, \dots, t_5 \in B \cap C$
13. $t_1, \dots, t_5 \in A \cap C$
14. $t_1, \dots, t_5 \in B \cap C$
15. $t_1, \dots, t_5 \in A \cap C$
16. $t_1, \dots, t_5 \in B \cap C$

Conclusion:

"half of the tickets in the bag $\in A \cap D$

$\therefore P(t_1, \dots, t_5 \in A \cap D) = (\frac{1}{2})^5 = \frac{1}{32}$

Case 2:

$\because$ half of the tickets in the bag $\in B \cup D$

$\therefore P(t_1, \dots, t_5 \in B \cup D) = (\frac{1}{2})^5 = \frac{1}{32}$

Similarly, for Case 3, 4, $P(t_1, \dots, t_5 \in A \cup C) = \frac{1}{32}$

$P(t_1, \dots, t_5 \in B \cup C) = \frac{1}{32}$

But all of the tickets $\in A \cup \in B \cup \in C \cup \in D$ are counted repeatedly

$\therefore$ we need to substract $(\frac{1}{4})^5 \times 4 = \frac{1}{256}$

Consider the case that if we have 3 kinds in the 5 tickets.

1. $t_1, \dots, t_5 \in [B, C, D]$ → $[1, 3, 5, 7]$ not all green $\because \exists t_i \in [B \cup C]$
2. $t_1, \dots, t_5 \in [A, C, D]$ $[2, 4, 6, 8]$ not all green $\because \exists t_i \in [C]$
3. $t_1, \dots, t_5 \in [A, B, D]$ $[9, 11, 13, 15]$ not all green $\because \exists t_i \in [B \cup D]$
4. $t_1, \dots, t_5 \in [A, B, C]$ $[10, 12, 14, 16]$ not all green $\because \exists t_i \in [D]$

It is similar for the cases $2 \sim 4$, and also the case $t_1, \dots t_5 \in [A, B, C, D]$

Thus, the probability of winning the prize B:

$$\frac{1}{32} \times 4 - \frac{1}{256} = \frac{32}{256} - \frac{1}{256} = \frac{31}{256} \quad \square$$