

## Counting Problems

① unique:  $\frac{7!}{3!} = 7 \cdot 6 \cdot 5 \cdot 4 = \boxed{840}$   
all possible:  $7! = \boxed{5040}$

② two values:  $\frac{13!}{2!11!} = 78$   
two suits:  $\left(\frac{4!}{2!2!}\right)^2 = 36$   
final card:  $\frac{11!}{1!10!} = 11$   
final card suit:  $\frac{4!}{3!} = 4$   
 $78 \cdot 36 \cdot 11 \cdot 4 = \boxed{123,552}$

③  $\frac{16!}{1!15!} \cdot \frac{15!}{6!9!} = \boxed{80080}$

④

$\begin{array}{c} 3 \\ \swarrow \quad \searrow \\ 1, 2 \quad 9 \\ \quad \swarrow \quad \searrow \\ 4, 5, 6, 7, 8 \quad 10, 11, 12 \end{array}$

$\frac{\frac{4!}{2!2!}}{3} \cdot \frac{\frac{10!}{5!5!}}{6} \cdot \frac{\frac{6!}{3!3!}}{4} = \boxed{420}$

⑤  $3+4+5+6+7+8+9+10 = 52$