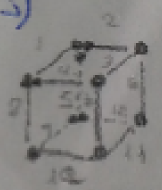
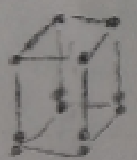
3)



No Rotation	(1)(2)(3)(4)(5)(6)(7)(8)(9)(10)(11)(12)	$(1)^{12}$	1
Rotate around face centers 90°	(1 2 3 4)(5 6 7 8)(9 10 11 12)	$(4)^3$	6
Rotate around face centers 180°	(1 3)(2 4)(5 7)(6 8)(9 11)(10 12)	$(2)^6$	3
Rotate around middle.	(1 12)(2 11)(3 10)(4 9)(5 7)(6 8)	$(2)^6$	6
Rotate around diag ±120°	(1 7 10)(2 3 6)(4 11 5)(8 9 12)	$(3)^4$	8



2^{12}

$$\left[\left(2^{12} + 6 \cdot \underline{2}^3 + 9 \cdot 2^6 + 8 \cdot 2^4\right)\right] / 24 = \boxed{202}$$

→ There are two possible solutions for each of the matches. Can be considered as having two colors.

Combinatorics HW9.1 2019280366 Albert Sebastián Millán Traypls

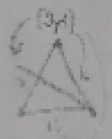
1) The number of colorings for the triangles: $3^3 = 27$

Group of symmetries: $D_3 = \{\rho_3^0 = \iota, \rho_3, \rho_3^2, \tau_1, \tau_2, \tau_3\}$

$$|D_3| = 6$$

$$|C(\rho_3^i)| = \begin{cases} 27 & \text{if } i = 0 \\ 3 & \text{if } i = 1, 2 \end{cases}$$

$$\therefore N(D_3, C) = \frac{1}{6}(27 + 3 \cdot 2 + 9 \cdot 3) = \frac{60}{6} = \boxed{10}$$



To be fixed, colors must be identical

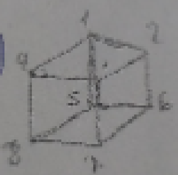
a = b

a = 3 choices

b = 3 choices

$3 \times 3 = 9$

2)



- No mov.	$(1)^8$	1
- Face center to face center rotate $\pm 90°$	$(4)^2$	$2 \cdot 3$
- Face center to face center rotate $180°$	$(2)^4$	3
- Edge middle point to edge middle point $180°$	$(2)^4$	6
- Diagonal line as shaft rotate $\pm 120°$	$(1)^2(3)^2$	$2 \cdot 4$
- Order 24		

$$\Rightarrow p = [(r+b+d)^8 + (r^4+b^4+d^4)^2 6 + (r^2+b^2+d^2)^4 \cdot 9 + 8 \cdot (r+b+d)^2 (r^3+b^3+d^3)^2] / 24$$

$$= [(C\binom{8}{2} \cdot C\binom{6}{2}) + 0 + 9 \cdot (C\binom{4}{2} \cdot C\binom{2}{1}) + 0] / 24$$

$$= [420 + 9 \cdot 12] / 24$$

$$= \boxed{22}$$