Staple!

**Ord:** ___ ___

Abstract Algebra
MAS4301 09B1

**Class-C**

Prof. JLF King
Wednesday, 20Nov2019

**Hi.** Write **DNE** if the object does not exist or the operation cannot be performed. NB: **DNE** $\neq \{\} \neq 0 \neq$ *Empty-word*.

**C1:** Show no work. a A *minimum* requirement for an LOR (letter-of-recommendation) from Prof. K is two courses. Circle:

**Yes** **True** **Darn tootin'!**

___ b From class, the group $G$ of OP-isometries [Orientation-Preserving] of the cube is isomorphic to ______.

Two colorings of the twelve *edges* of the cube using $K$ colors, are ***equivalent*** IFF some OP-isometry carries one to the other. To compute $\mathcal{E}(K)$, the number of equiv-classes, fill in this table.

| What isometry $g$? | $^{\#}\{\text{such } g\}$ | $^{\#}\text{Fix}(g) = K^E$. | $E := {}^{\#}$[Edge-orbits under $\langle g\rangle$]. |
|---|---|---|---|
| *Id* | 1 | $K^{12}$ | $\lceil 1^{12}\rfloor$ |
| FaceRot 90° | | | |
| FaceRot 180° | | | |
| VertexRot 120° | | | |
| EdgeRot 180° | | | |

*And* $\mathcal{E}(K) =$ ____ $\cdot\left[K^{12} + \right.$ ______________ $\left.\right]$.

___ c A finite group $\Gamma$ acts on a finite set $\Omega$. *Then...*
The number of $\Gamma$-orbits divides $|\Gamma|$: *T* *F*
Cardinality of *each* $\Gamma$-orbit divides $|\Gamma|$: *T* *F*

___ d In $\mathbb{D}_8 = \langle \mathtt{R}, \mathtt{F}\rangle$, the conjugacy-class of $\mathtt{R}^3\mathtt{F}$ is
$\mathbb{C}(\mathtt{R}^3\mathtt{F}) = \{$ ______ $\}$ and $\mathbb{C}(\mathtt{R}^3) = \{$ ______ $\}$.
The number of conjugacy-classes is ______.

___ e Endomorphism $f\colon(\mathbb{Z}_{40}, +, 0) \to (\mathbb{Z}_{40}, +, 0)$ has kernel $\text{Ker}(f) = \{0, 8, 16, 24, 32\}$ *and* [this is the part I forgot to put back in] $f(3) = 5$. Writing $\mathbb{Z}_{40}$ as $[0 .. 40)$, then,
$f^{-1}(15) = \{$ ______ $\}$.

OYOP: *In grammatical English* ***sentences****, write your essay on every* $2^{\text{nd}}$ *line* (usually)*, so that I can easily write between the lines.*

**C2:** Distinct elements $\alpha, \beta \in G$ each have order 2. Prove there exists another order-2 element. [Recall "Ord$(y) = 2$" means $y^2 = \mathbf{e}$, *yet* $y \neq \mathbf{e}$.] [*Hint:* One way is to start with $\alpha\beta\alpha$.]

End of Class-C

| | | |
|---|---|---|
| **C1:** | ___ ___ ___ | 160pts |
| **C2:** | ___ ___ | 60pts |
| **Total:** | ___ ___ ___ | 220pts |

NAME: ______ Ord: ______

HONOR CODE: *"I have neither requested nor received help on this exam other than from my professor."*

Signature: ______