Staple!

Ord: ___ ___

Sets and Logic
MHF3202 09EH

Class-A

Prof. JLF King
Wedn., 12Feb2020

A4: Short answer. Show no work.
Write **DNE** if the object does not exist or the operation cannot be performed. NB: DNE $\neq \{\} \neq 0$.

(+ 15) a Prof. King wears bifocals, and cannot read small handwriting. Circle one: **True!** **Yes!** ***Who??***

(+ 20) b Write the truth-table for $B \Rightarrow [[\neg B] \Rightarrow C]$.

B	C	$\neg B$	$[\neg B] \Rightarrow C$	$B \Rightarrow [[\neg B] \Rightarrow C]$
T	T			
T	F			
F	T			
F	F			

(+ 5 15) c LBolt gives $G := \text{GCD}(23, 413) =$ ________. And $23S + 413T = G$, where $S=$ ________ & $T=$ ________ are integers.

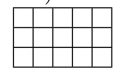
(+ 20) d The physics lab has atomic *zinc*, *tin*, *silver* and *gold*. I'm allowed to take 6 atoms, so I have [expressed as single integer] ________ many possibilities.

(+ 5 10 5) e The ***Kiko-numbers*** comprise $\mathcal{K} := 1 + 3\mathbb{N}$.
$\mathcal{K}$-number $385 \stackrel{\text{note}}{=\!=} 35 \cdot 11$ is $\mathcal{K}$-*irreducible*: T F

Kiko $N := 85$ is **not** $\mathcal{K}$-*prime* because $\mathcal{K}$-numbers $J :=$ ________ and $K :=$ ________ satisfy that $N \bullet\!| [J \cdot K]$, **yet** $N \nmid J$ and $N \nmid K$.

Also, $\mathcal{K}$-GCD$(175, 70) =$ ________.

OYOP: *In grammatical English* sentences*, write your essay on every 2*nd *line* (usually)*, so I can easily write between the lines.*

A5: An ***Lmino*** (pron. "ell-mino") comprises three  squares in an "L" shape (all four orientations are allowed). For natnum N, let $\mathbf{R}_N$ denote the $3 \times N$ board: I.e,  is the $\mathbf{R}_5$ board. Prove:

Theorem: When N is odd, then board $\mathbf{R}_N$ is not Lmino-tilable.

You will likely want to first *state* and *prove* a Lemma. Now use appropriate induction on N to prove the thm. Also: *Illustrate your proof* with (probably several) large, *labeled* pictures.

A bit of Extra Credit: *For $N = 2H$ even, our $\mathbf{R}_N$ has exactly* ________ *many Lmino-tilings.*

A6: Interval-of-integers $\mathbf{J} := [201 \,..\, 300)$ has 99 elements. A subset $S \subset \mathbf{J}$ is ***Big*** if $|S| = 51$. Subset $S \subset \mathbf{J}$ is ***Perfect*** if there exist *distinct* members $x, y \in S$ st. $x + y = 500$.

Prove that Big $\Rightarrow$ Perfect. [*Hint:* PHP. *Carefully* specify what your pigeon-holes are.]

End of Class-A

A4:	___ ___	95pts
A5:	___ ___	45pts
A6:	___ ___	35pts
Total:	___ ___ ___	175pts

Name: ________ Ord: ________

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

Signature: ________