Sets and Logic
MHF3202 8768

Class-W

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29Feb2017

W4: Short answer. Show no work.
Write **DNE** in a blank if the described object does not exist or if the indicated operation cannot be performed.

a $\mathcal{P}(\mathcal{P}(\text{3-stooges}))$ has ________ many elements.

b Given sets with cardinalities $|B| = 8$ and $|E| = 5$, the number of non-constant fncs in B^E is ________.

c *On $\mathbb{R}_+$, define several relations: Say that $x\mathcal{R}y$ IFF $y - x < 17$. Define $\mathcal{P}$ by: $x\mathcal{P}y$ IFF $x^{\log(y)} = 5$.*
Say that $x\mathcal{I}y$ IFF $x + y$ is irrational.
Use $\bullet|$ for the "divides" relation on the positive integers: $k \bullet| n$ iff there exists a posint r with $rk = n$.

c_1 Please circle those of the following relations which are *transitive* (on their domain of defn).

$\neq$ $\bullet|$ $\leqslant$ $\mathcal{R}$ $\mathcal{P}$ $\mathcal{I}$

c_2 Circle the *symmetric* relations:

$\neq$ $\bullet|$ $\leqslant$ $\mathcal{R}$ $\mathcal{P}$ $\mathcal{I}$

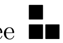
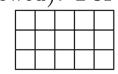
c_3 Circle the *reflexive* relations:

$\neq$ $\bullet|$ $\leqslant$ $\mathcal{R}$ $\mathcal{P}$ $\mathcal{I}$

d We consider binrels on $\Omega := \text{Stooges} := \{M, L, C\}$.
There are ________ **Anti-reflexive** binrels, and ________ **Reflexive** binrels, and ________ **Symmetric** binrels. The number of **strict total-orders** is ________.

e Define $G:[1..12] \circlearrowleft$ where $G(n)$ is the number of letters in the n^{th} Gregorian month. So $G(2) = 8$, since the 2^{nd} month is "February". The only fixed-point of G is ____. The *set* of posints k where $G^{\circ k}(12) = G^{\circ k}(7)$ is ________.
[January, February, March, April, May, June, July, August, September, October, November, December]

OYOP: *In grammatical English* ***sentences****, write your essay on every* ***third*** *line* (usually)*, so that I can easily write between the lines.* Please number the pages "1 of 57", "2 of 57"... (or "1/57", "2/57"...) I suggest you put your name on each sheet.

W5: 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.

End of Class-W

W4:	___ ___ ___	116pts
W5:	___ ___	75pts
Total:	___ ___ ___	191pts