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Math 330 - 03 Homework (Fall 2018)

- LaTeX-ed solutions are encouraged and appreciated.
- If you use LaTeX, hand-in a printed version of your homework.
- You are encouraged to discuss homework problems with classmates, but such discussions should NOT include the exchange of any written material.
- Writing of homework problems should be done on an individual basis.
- References to results from the textbook and/or class notes should be included.
- The following lists should be considered partial and tentative lists until the word complete appears next to it.
- Use 8.5in x 11in paper with smooth borders. Write your **name** on top of **each page**. Staple all pages.

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Problem Set 11 (complete) Due: 11/12/2018. Board presentation: 11/16/2018

- Prove the following corollary to Prop. 10.4 Corollary: \$\qlb(\R^+)=0\$.
- 2. Prove Prop. 10.7
- 3. Prove Prop. 10.10.iii
- 4. Prove Prop. 10.13.ii

Problem Set 10 (complete) Due: 11/05/2018. Board presentation: 11/14/2018

- 1. Let \$f:A\to B\$ and \$g:B\to C\$ be functions.
 - I. If \$g\circ f\$ is injective, then \$f\$ is injective.
 - II. If \$g\circ f\$ is surjective, then \$g\$ is surjective.
- 2. Construct examples of functions \$f:A\to B\$ and \$q:B\to C\$ such that:
 - I. \$g\circ f\$ is injective, but \$g\$ is not injective.
 - II. \$g\circ f\$ is surjective, but \$f\$ is not surjective.
- 3. Prove Prop. 9.15 (Hint: induction)
- 4. Prove Prop. 9.18

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Problem Set 09 (complete) Due: 10/29/2018. Board presentation: 11/05/2018

- 1. Prove Prop. 8.40.ii
- 2. Prove Prop. 8.41
- 3. Prove Prop. 8.50
- 4. Give examples of subsets of \$\R\$ which are:
 - I. bounded below and above,
 - II. bounded below, but not bounded above,
 - III. bounded above, but not bounded below,
 - IV. not bounded above or below.

Problem Set 08 (complete) Due: 10/22/2018. Board presentation: 10/31/2018

- 1. Prove Prop. 6.16
- 2. Prove Prop. 6.17
- 3. Prove Prop. 6.25 (first part)
- 4. Use Euclid's Lemma to prove the following corollary. Let \$p\$ be a prime, \$k\in\N\$, \$m_1,m_2,\dots,m_k\in\N\$. If \$p|(m_1m_2\cdots m_k)\$ then there is some \$i\$ with \$1\leq i \leq k\$ such that \$p|m_i\$. (Hint: Use induction on \$k\$).

Problem Set 07 (complete) Due: 10/15/2018. Board presentation: 10/31/2018

- 1. Let \$A\$ be a set, and \$\sim\$ an equivalence relation on \$A\$. Let \$A\sim\$ be the partition consisting of all equivalence classes of \$\sim\$. Let \$\Theta_{(A\sim)}\$ be the equivalence relation induced by the partition \$A\sim\$. Prove that \$\Theta_{(A\sim)}=\\sim\$.
- 2. Do Project 6.8.iv.

Problem Set 06 (complete) Due: 10/08/2018. Board presentation: 10/31/2018

- Prove that set union is associative.
- 2. Show, by counterexample, that set difference is not associative.
- 3. Prove Prop. 5.20.ii
- 4. Let \$X\$ and \$Y\$ be sets. Let \$\power(X)\$ denote the power set of \$X\$. Prove that: \[X\subseteq Y \iff \power(X)\subseteq\power(Y).\]
- 5. (challenge) Prove that symmetric difference is associative.

Problem Set 05 (complete) Due: 10/01/2018. Board presentation: 10/05/2018

- 1. Prove Prop. 4.6.iii
- 2. Prove Prop. 4.11.ii
- 3. Prove Prop. 4.15.i
- 4. Prove Prop. 4.16.ii

Problem Set 04 (complete) Due: 09/17/2018. Board presentation: 09/21/2018

- 1. Prove Prop. 2.38 (appendix)
- 2. Prove Prop. 2.41.iii (appendix)

Problem Set 03 (complete) Due: 09/12/2018. Board presentation: 09/17/2018

- 1. Prove that for all $k\in N$, k^2+k is divisible by 2.
- 2. Prove Prop. 2.18.iii
- 3. Prove Prop. 2.21. Hint: use proof by contradiction.
- 4. Prove Prop. 2.23. Show, by counterexample, that the statement is not true if the hypothesis \$m,n\in\N\$ is removed.
- 5. Fill-in the blank and prove that for all $k\leq \sqrt{1}$, $k^2 < 2^k$.

Problem Set 02 (complete) Due:09/05/2018. Board presentation: 09/10/2018

- 1. Prove Prop. 1.24
- 2. Prove Prop. 1.27.ii,iv
- 3. Prove Prop. 2.7.i,ii
- 4. Prove Prop. 2.12.iii

Problem Set 01 (complete) Due: 08/27/2018. Board presentation: 08/31/2018

- 1. Prove Prop. 1.7
- 2. Prove Prop. 1.11.iv
- 3. Prove Prop. 1.14
- 4. Prove that $1 + 1 \neq 1$. (Hint: assume otherwise, and get a contradiction). Can you prove that $1 + 1 \neq 0$?

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