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Math 330 - 02 Previous Homework

- 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.

\$\newcommand{\aut}{\textrm{Aut}} \newcommand{\sub}{\textrm{Sub}} \newcommand{\join}{\vee} \newcommand{\bigjoin}{\bigvee} \newcommand{\bigmeet}{\bigwedge} \newcommand{\bigmeet}{\bigwedge} \newcommand{\lointersection}{\cap} \newcommand{\lointersection}{\cap} \newcommand{\bigunion}{\bigcup} \newcommand{\bigintersection}{\bigcap} \newcommand{\sq}[2][\]{\sqrt[#1]{#2\,}} \newcommand{\bigintersection}{\bigcap} \newcommand{\sq}[2][\]{\sqrt[#1]{#2\,}} \newcommand{\pbr}[1]{\langle #1\rangle} \newcommand{\ds}{\displaystyle} \newcommand{\C}{\mathbb{C}} \newcommand{\C}{\mathbb{Z}} \newcommand{\N}{\mathbb{R}} \newcommand{\C}{\mathbb{R}} \newcommand{\C}{\mathbb{F}} \newcommand{\lointersection}{\lointersection}{\mathbb{R}} \newcommand{\lointersection}{\mathbb{R}} \newcommand{\C}{\mathbb{C}} \newcommand{\C}{\mathbb{C}} \newcommand{\C}{\mathbb{C}} \newcommand{\C}{\mathbb{E}} \newcommand{\lointersection}{\mathbb{R}} \newcommand{\lointersection}{\mathbb{R}} \newcommand{\lointersection}{\mathcal{P}} \newcommand{\calR}{\mathcal{P}} \newcommand{\calR}{\mathcal{P}} \newcommand{\calR}{\mathcal{R}} \newcommand{\calR}} \newcommand{\calR}{\mathcal{R}} \newcommand{\calR}} \newcommand{\calR}}

Problem Set 10 (complete) Due: 11/17/2017. Board Presentation: 11/17/2017

- 1. Prove Prop. 10.23.v
- 2. Prove The. 10.26
- 3. Let \$(a_n)\$ be a sequence. Consider the sequence of even-indexed terms, \$(a_{2n})\$, and the sequence of odd-indexed terms, \$(a_{2n+1})\$. Prove that if both \$(a_{2n})\$ and \$(a_{2n+1})\$ converge to \$L\$, then \$(a_n)\$ converges to \$L\$.
- 4. Let $q_n=\displaystyle\frac\{f_n\}\{f_{n+1}\}\$, where f_n is the n-th Fibonacci number. Show that the sequence (q_n) converges. What value does it converge to?

Problem Set 9 (complete) Due: 11/10/2017. Board presentation: 11/10/2017

- 1. Prove Prop. 10.10.iii
- 2. Prove Prop. 10.17
- 3. Prove Prop. 10.23.iii

Problem Set 8 (complete) Due: 11/03/2017. Board presentation: 11/03/2017

- 1. Prove Prop. 8.50
- 2. Prove that function composition is associative, when defined.

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- 3. Let \$A,B,C\$ be sets and \$f:A\to B\$ and \$g:B\to C\$ functions. Prove that if \$g\circ f\$ is surjective then \$g\$ is surjective. Give an example when \$g\circ f\$ is surjective, but \$f\$ is not.
- 4. Construct an example of a function with several right inverses.
- 5. Prove Prop. 9.15 (Hint: induction on \$k\$)
- 6. Prove Prop. 9.18

Problem Set 7 (complete) Due: 10/27/2017. Board presentation: 10/27/2017

- 1. Prove the corollary to Prop. 6.25: Let $a,b\in X$, $n\in X$ and $k\neq 0$. If $a \neq 0$. If a
- 2. Prove Prop. 8.6
- 3. Prove Prop. 8.40.ii
- 4. Prove Prop. 8.41

Problem Set 6 (complete) Due: 10/13/2017. Board presentation: 10/20/2017

- 1. Let f_n be the n-th Fibonacci number. Prove by induction on n that $\int \int_{a}^{1} n f_{2j} = f_{2n+1}-1$
- 2. Find and write down all the partitions on a 4-element set \$A=\{a,b,c,d\}\$. How many equivalence relations are there on \$A\$?
- 3. Prove Prop. 6.15
- 4. Prove Prop. 6.16

Problem Set 5 (complete) Due: 10/06/2017. Board presentation: 10/18/2017

- 1. Let \$n\in\N\$. Prove that if \$n\$ is divisible by 3, then \$f_n\$ is even. Is the converse true? If so, prove it; if not, give a counterexample.
- 2. Let \$n\in\N\$. Prove that if \$n\$ is divisible by 5, then \$f_n\$ is divisible by 5. Is the converse true? If so, prove it; if not, give a counterexample.
- 3. Prove the following identities for the Fibonacci numbers \[f_{2n+1}=f_n^2+f_{n+1}^2;\quad \\ f_{2n}=f_{n+1}^2-f_{n-1}^2 = f_n(f_{n+1}+f_{n-1}) \]
- 4. Prove the associativity of the set union and set intersection operations. Give a counterexample to show that set difference is not associative.

Problem Set 4 (complete) Due: 09/29/2017. Board presentation: 10/06/2017

- 1. Prove Prop. 4.6.iii
- 2. Prove Prop. 4.11.ii
- 3. Do project 4.12
- 4. Prove Prop. 4.16.ii

Problem Set 3 (complete) Due: 09/15/2017. Board presentation: 09/20/2017

- 1. Prove Prop. 2.21 (Hint: proof by contradiction)
- 2. Prove Prop. 2.23. Show, by counterexample, that the statement is not true when the hypothesis \$m,n\in\N\$ is removed.
- 3. Prove Prop. 2.38 (appendix)
- 4. Prove Prop. 2.41.iii (appendix)

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Problem Set 2 (complete) Due: 09/08/2017. Board presentation: 09/15/2017

- 1. Prove Prop. 1.25
- 2. Prove Prop. 1.27.iv
- 3. Prove Prop. 2.7
- 4. Prove transitivity of \$"\leq"\$.

Problem Set 1 (complete) Due: 09/01/2017. Board Presentation: 09/08/2017

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

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