Math 401 - 01 Homework (Fall 2018)

$\newcommand{\aut}{\textrm{Aut}} \newcommand{\inn}{\textrm{Inn}} \newcommand{\sub}{\textrm{Sub}} \newcommand{\cl}{\textrm{cl}} \newcommand{\join}{\vee} \newcommand{\bigjoin}{\bigvee} \newcommand{\meet}{\wedge} \newcommand{\bigmeet}{\bigwedge} \newcommand{\normaleq}{\unlhd} \newcommand{\normal}{\lhd} \newcommand{\union}{\cup} \newcommand{\intersection}{\cap} \newcommand{\bigunion}{\bigcup} \newcommand{\bigintersection}{\bigcap} \newcommand{\sq}[2][\ ]{\sqrt[#1]{#2\,}} \newcommand{\pbr}[1]{\langle #1\rangle} \newcommand{\ds}{\displaystyle} \newcommand{\C}{\mathbb{C}} \newcommand{\R}{\mathbb{R}} \newcommand{\Q}{\mathbb{Q}} \newcommand{\Z}{\mathbb{Z}} \newcommand{\N}{\mathbb{N}} \newcommand{\A}{\mathbb{A}} \newcommand{\F}{\mathbb{F}} \newcommand{\T}{\mathbb{T}} \newcommand{\ol}[1]{\overline{#1}} \newcommand{\imp}{\Rightarrow} \newcommand{\rimp}{\Leftarrow} \newcommand{\pinfty}{1/p^\infty} \newcommand{\power}{\mathcal{P}} \newcommand{\calL}{\mathcal{L}} \newcommand{\calC}{\mathcal{C}} \newcommand{\calN}{\mathcal{N}} \newcommand{\calB}{\mathcal{B}} \newcommand{\calF}{\mathcal{F}} \newcommand{\calR}{\mathcal{R}} \newcommand{\calS}{\mathcal{S}} \newcommand{\calU}{\mathcal{U}} \newcommand{\calT}{\mathcal{T}} \newcommand{\gal}{\textrm{Gal}} \newcommand{\isom}{\approx} \newcommand{\idl}{\textrm{Idl}} \newcommand{\lub}{\textrm{lub}} \newcommand{\glb}{\textrm{glb}} $

Problem Set 13 (complete) Due: 12/10/2018, optional (bring to review session)

1. Let D be an I.D., $D[x]$ the ring of polynomials over D, and $D(x)$ the field of rational functions over D. Let F be the field of fractions of D, $F[x]$ the ring of polynomials over F, and $F(x)$ the field of rational functions over F. Show that $D(x)=F(x)$.
2. Prove that the operation that defines the external semi-direct product is in fact associative.
3. Prove that the two non-abelian semi-direct products of C_7 with C_3 are isomorphic. (Hint: use the homomorphism discussed in class, given by: $a\mapsto u, b\mapsto v^{-1}$)

Problem Set 12 (complete) Due: 12/03/2018. Board presentation: 12/07/2018

1. Chapter 14, problems 12, 14. Warning: pay attention to the definition of AB.
2. Chapter 14, problem 28. What about the converse?
3. Write $n\in\Z$ as md_0, where d_0 is the last digit (base 10) and m consists of all other digits. In other words, $n=10 m+d_0$. Prove that n is divisible by 7 iff $m-2d_0$ is divisible by 7.

Problem Set 11 (complete) Due: 11/20/2018. Board presentation: 11/27/2018

1. Chapter 12, problem 18. Moreover, if R is commutative, then S is an ideal of R.
2. Chapter 12, problem 28.
3. Chapter 13, problem 52.
4. Chapter 13, problem 34.

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