

DATE	TOPICS and SECTION of Lorenz (subject to change) tba = "to be announced" tbc = "to be confirmed"	HOMEWORK Worth 100% of course grade. Due dates & list of problems are fixed after announcement. 75 problems total. Complete >30 for B, >50 for A. If your (future) area of research involves representation theory, then completing >70 is advised. Due at start of class. No late submissions allowed w/o official excuse.	Supplementary Material and Misc. Notes
T Aug 28	Course Mechanics §1.1 Algebras > Algebras > §§1.1.1, 1.1.2, 1.1.3, some of 1.1.4		You may want to read the <a href="https://arxiv.org/abs/1808.03172">Article</a> https://arxiv.org/abs/1808.03172 for an informal introduction to representation theory and noncommutative algebra before the start of the course.  It may also be helpful to read Appendices A and B of Lorenz sometime at the beginning of the course; this material will not be covered in lectures but will be used freely throughout the semester.  Lecture Notes: <a href="https://www.dropbox.com/s/d7iqnjohz2gue04/1.1-Algebras-20180828.pdf?dl=0">https://www.dropbox.com/s/d7iqnjohz2gue04/1.1-Algebras-20180828.pdf?dl=0</a>
Th Aug 30	§1.2 Algebras > Representations > §§1.2.1, 1.2.2, 1.2.3		Lecture Notes including Addendum on Trivial Representations: <a href="https://www.dropbox.com/s/hhxx3dnxj4qn1n9/1.2-Reps-of-Algs-20180830.pdf?dl=0">https://www.dropbox.com/s/hhxx3dnxj4qn1n9/1.2-Reps-of-Algs-20180830.pdf?dl=0</a>  Article: "History and variation on the theme of the Frobenius Reciprocity theorem" by Floyd L. Williams <a href="https://link.springer.com/content/pdf/10.1007/BF03023838.pdf">https://link.springer.com/content/pdf/10.1007/BF03023838.pdf</a>
T Sept 4	§1.2 Algebras > Representations > §§1.2.4, 1.2.5, 1.2.6		Lecture Notes including Addendum on Gabriel's Theorem and the Representation Theory of (Path Algebras of) Quivers: <a href="https://www.dropbox.com/s/mqhcmo1vcfcgfh0/1.2-Reps-of-Algs-20180904.pdf?dl=0">https://www.dropbox.com/s/mqhcmo1vcfcgfh0/1.2-Reps-of-Algs-20180904.pdf?dl=0</a>  See Assem, Simson, and Skowronski's "Elements of the Representation Theory of Associative Algebras" for further details on the Addendum above.
Th Sept 6	§1.3 Algebras > Primitive Ideals > §§1.3.1, 1.3.2, 1.3.3, 1.3.5	Homework #1 on §1.1 and §1.2 due: (1) 1.1.2; (2) 1.1.3; (3) 1.1.5; (4) 1.1.6; (5) 1.1.7; (6) 1.1.8; (7) 1.1.14; (8) 1.1.15; (9) 1.1.16; (10) 1.2.1 and 1.2.2; (11) 1.2.3;	Lecture Notes including Instructor notes on the Geometry of irreps of fin. gen. (PI) algebras: <a href="https://www.dropbox.com/s/094uvj4mriec2q/1.3-Primitive-Ideals-20180906.pdf?dl=0">https://www.dropbox.com/s/094uvj4mriec2q/1.3-Primitive-Ideals-20180906.pdf?dl=0</a>  See texts of Goodearl-Warfield and Brown-Goodearl for more info.
T Sept 11	§1.4 Algebras > Semisimplicity > §§1.4.1 - 1.4.4, 1.4.7		Lecture Notes: <a href="https://www.dropbox.com/s/d5n1wptcc6rpld/1.4-Semisimplicity-20180911.pdf?dl=0">https://www.dropbox.com/s/d5n1wptcc6rpld/1.4-Semisimplicity-20180911.pdf?dl=0</a>
Th Sept 13	§1.5 Algebras > Characters > §§1.5.1, 1.5.2, 1.5.4		Lecture Notes: <a href="https://www.dropbox.com/s/v3hc28mo6okzjp1/1.5-Characters-20180913.pdf?dl=0">https://www.dropbox.com/s/v3hc28mo6okzjp1/1.5-Characters-20180913.pdf?dl=0</a>
T Sept 18	§2.1 and 2.2 Algebras > Projective and Injective Modules, Frobenius and Symmetric Algebras > §§2.1.1, 2.1.4, 2.2.1, 2.2.2, 2.2.6, 2.2.9		Lecture Notes: <a href="https://www.dropbox.com/s/18n8eqqb9a9f50j/2.0-Frobenius-Algs-20180918.pdf?dl=0">https://www.dropbox.com/s/18n8eqqb9a9f50j/2.0-Frobenius-Algs-20180918.pdf?dl=0</a>  Also covered a bit of §9.1.4  Course lecture on 2d-TFTs and (commutative, cocommutative) Frobenius algebras by Christopher Douglas: <a href="https://www.youtube.com/watch?v=hB6wgY5K_84">https://www.youtube.com/watch?v=hB6wgY5K_84</a>
Th Sept 20	§3.1 Groups > Generalities > §§3.1.1 - 3.1.4	Homework #2 on §1.2, §1.3, §1.4, and §1.5 due (12) 1.2.6; (13) 1.2.7; (14) 1.2.9; (15) 1.3.3; (16) 1.4.1; (17) 1.4.2; (18) 1.4.4; (19) 1.4.11; (20) 1.5.1 and 1.5.2 (21) 1.5.4; (22) 1.5.7;	Lecture Notes: <a href="https://www.dropbox.com/s/5vqqoexu4i8fror/3.1-Reps-of-Groups-20180920.pdf?dl=0">https://www.dropbox.com/s/5vqqoexu4i8fror/3.1-Reps-of-Groups-20180920.pdf?dl=0</a>
T Sept 25	§3.1 and 3.2 Groups > Generalities and First Examples > §§3.1.5, 3.1.6, example from 3.2		Substitute instructor  Lecture Notes: <a href="https://www.dropbox.com/s/6q11e5d03z035vx/3.1-Reps-of-Groups-20180925.PDF?dl=0">https://www.dropbox.com/s/6q11e5d03z035vx/3.1-Reps-of-Groups-20180925.PDF?dl=0</a>
Th Sept 27	§3.2 Groups > First Examples > Rest of §3.2		Substitute instructor  Lecture Notes: <a href="https://www.dropbox.com/s/hth1xunjwye6o5/3.2-Reps-of-Groups-Examples-20180927.pdf?dl=0">https://www.dropbox.com/s/hth1xunjwye6o5/3.2-Reps-of-Groups-Examples-20180927.pdf?dl=0</a>
T Oct 2	§3.3 Groups > More Structure		Lecture Notes: <a href="https://www.dropbox.com/s/knvzq63n7a1zp22/3.3-Reps-of-Groups-More-Structure-20181002.pdf?dl=0">https://www.dropbox.com/s/knvzq63n7a1zp22/3.3-Reps-of-Groups-More-Structure-20181002.pdf?dl=0</a>
Th Oct 4	§3.4 Groups > Semisimple Group Algs and Snippet of §3.6 (pertaining to char's)	Homework #3 on Ch 2, §3.1, and §3.2 due (23) 2.1.1; (24) 2.1.2; (25) 2.2.3(a,b); (26) 2.2.8; (27) 3.1.2; (28) 3.1.3; (29) 3.1.4; (30) 3.2.1; (31) 3.2.3; (32) 3.2.5;	Read §3.5  Lecture Notes: <a href="https://www.dropbox.com/s/bfxtmbyibw8uu1v/3.4-and-part-of-3.6-20181004.pdf?dl=0">https://www.dropbox.com/s/bfxtmbyibw8uu1v/3.4-and-part-of-3.6-20181004.pdf?dl=0</a>
T Oct 9	§3.7 Groups > Application to Inv Thy (first wrap up FS-indicators)		Lecture Notes: <a href="https://www.dropbox.com/s/afasqbu4jc1iz8k/3.7-Inv-Thy-FS-indicators-20181009.pdf?dl=0">https://www.dropbox.com/s/afasqbu4jc1iz8k/3.7-Inv-Thy-FS-indicators-20181009.pdf?dl=0</a>  Article: "A Frobenius-Schur Theorem for Hopf algebras" by Vitaly Linchenko and Susan Montgomery (see Oct 2 lecture for definition of Hopf algebra) <a href="https://link.springer.com/content/pdf/10.1023%2FA%3A1009949909889.pdf">https://link.springer.com/content/pdf/10.1023%2FA%3A1009949909889.pdf</a>
W Oct 10 @7pm 243 Altgeld	Rest of Groups §3.7, §3.8 Groups > Decomp. tensor powers §§3.8.1 and 3.8.2		(dinner provided)  Lecture Notes: <a href="https://www.dropbox.com/s/64jhzbw0dbm08jm/3.7-3.8-Inv-Thy-Decompose-20181010.pdf?dl=0">https://www.dropbox.com/s/64jhzbw0dbm08jm/3.7-3.8-Inv-Thy-Decompose-20181010.pdf?dl=0</a>
Th Oct 11	§§4.1, 4.2 Symmetric Groups > Gelfand-Zetlin algebras and the Branching Graph (skipping §4.2.5, omitting some proofs)		Lecture Notes: <a href="https://www.dropbox.com/s/pmn4msu0zmi0r0/4.1-4.2-Branching-Graph-20181011.pdf?dl=0">https://www.dropbox.com/s/pmn4msu0zmi0r0/4.1-4.2-Branching-Graph-20181011.pdf?dl=0</a>
T Oct 23	§§4.3, 4.4 Symmetric Groups > The Young Graph and its isomorphism with Branching Graph (skipping pg 202-204, sketch §4.4)	Homework #4 on §3.3, §3.4, and §3.6 - 3.8 due (33) 3.3.4; (34) 3.3.10; (35) 3.3.11; (36) 3.4.5(a,b); (37) 3.4.5(c,d); (38) 3.4.7; (39) 3.6.3; (40) 3.7.3(a,b); (41) 3.7.3(c,d); (42) 3.7.5(a); (43) 3.8.1;	Lecture Notes: <a href="https://www.dropbox.com/s/igr8lijweb4e3a4/4.3-4.4-Young-Graph-20181023.pdf?dl=0">https://www.dropbox.com/s/igr8lijweb4e3a4/4.3-4.4-Young-Graph-20181023.pdf?dl=0</a>
W Oct 24 @7pm 241 Altgeld	§4.7 Symmetric Groups > Schur-Weyl Duality		(dinner provided)  Lecture Notes: <a href="https://www.dropbox.com/s/qynxgd4t8tp0b/4.7-Schur-Weyl-Duality-20181024.pdf?dl=0">https://www.dropbox.com/s/qynxgd4t8tp0b/4.7-Schur-Weyl-Duality-20181024.pdf?dl=0</a>  Talk on Representation theory and combinatorics of diagram algebras by Zaji Daugherty: <a href="https://www.youtube.com/watch?v=noh2AIUvJ2w">https://www.youtube.com/watch?v=noh2AIUvJ2w</a> Slides for talk: <a href="https://zdaugherty.ccnysites.cuny.edu/research/presentations/2016.05.15-braid-groups.pdf">https://zdaugherty.ccnysites.cuny.edu/research/presentations/2016.05.15-braid-groups.pdf</a>
Th Oct 25	§5.1 Lie Algebras and Enveloping Algs > Lie Algebra Basics		Lecture Notes: <a href="https://www.dropbox.com/s/rx9oxew8510wy39/5.1-Lie-Algebra-Basics-20181025.pdf?dl=0">https://www.dropbox.com/s/rx9oxew8510wy39/5.1-Lie-Algebra-Basics-20181025.pdf?dl=0</a>  Article on Sophus Lie by Gaston Darboux <a href="http://www.ams.org/journals/bull/1899-05-07/S0002-9904-1899-00628-1/S0002-9904-1899-00628-1.pdf">http://www.ams.org/journals/bull/1899-05-07/S0002-9904-1899-00628-1/S0002-9904-1899-00628-1.pdf</a>
T Oct 30	§5.2, 5.3 Lie Algs and Enveloping Algs > Types of Lie Algebras Three Theorems on Linear Lie Algebras,		Lecture Notes: <a href="https://www.dropbox.com/s/zk966af1ixybd34/5.2-5.3-Nilpotent-Solvable-LAs-20181030.pdf?dl=0">https://www.dropbox.com/s/zk966af1ixybd34/5.2-5.3-Nilpotent-Solvable-LAs-20181030.pdf?dl=0</a>
Th Nov 1	§5.3, 5.4 Lie Algs and Enveloping Algs > Three Theorems on Linear Lie Algebras, Enveloping Algebras	Homework #5 on §3.7 and Ch 4 due (44) Compute the 2nd FS-indicators of $S_4$ ; (45) Compute the 2nd FS-indicators of $Q_8$ ; (46) 3.7.2; (47) 3.3.15; (48) 3.7.4; (49) 4.1.1; (50) 4.1.2; (51) 4.2.3; (52) 4.2.4; (53) 4.3.4; (54) 4.4.4 for $n=4$ ;	Lecture Notes: <a href="https://www.dropbox.com/s/h49ejb0rj346ymx/5.3-5.4-Cartan-Criterion-Enveloping-Algs-20181101.pdf?dl=0">https://www.dropbox.com/s/h49ejb0rj346ymx/5.3-5.4-Cartan-Criterion-Enveloping-Algs-20181101.pdf?dl=0</a>  Article on Poincaré-Birkhoff-Witt theorems by Anne Shepler and Sarah Witherspoon: <a href="http://library.msri.org/books/Book67/files/150123-Shepler.pdf">http://library.msri.org/books/Book67/files/150123-Shepler.pdf</a>
T Nov 6	§5.4, 5.5 Lie Algs and Enveloping Algs > Enveloping Algebras Generalities on Reps of Lie Algs		Lecture Notes: <a href="https://www.dropbox.com/s/pmvm570rm45lm13/5.4-5.5-Generalities-of-Reps-Uqq-20181106.pdf?dl=0">https://www.dropbox.com/s/pmvm570rm45lm13/5.4-5.5-Generalities-of-Reps-Uqq-20181106.pdf?dl=0</a>  See Chapter 1 and Section 6.1.1 of Turaev-Virelizier's "Monoidal Categories and Topological Field Theory" for supplementary material.
Th Nov 8	§5.7 Lie Algs and Enveloping Algs > Representations of $sl_2$ (skipping §5.7.7 - 5.7.10)		Lecture Notes: <a href="https://www.dropbox.com/s/3v8306qa214t7kn/5.7-Representations-of-sl2-20181108.pdf?dl=0">https://www.dropbox.com/s/3v8306qa214t7kn/5.7-Representations-of-sl2-20181108.pdf?dl=0</a>
T Nov 13	§6.1 Characterizations of Semisimplicity, §6.2 Complete Reducibility (skipping §6.2.4)		Lecture Notes: <a href="https://www.dropbox.com/s/jp7s9l34sf2jnc6.1-6.2-Semisimple-LAs-20181113.pdf?dl=0">https://www.dropbox.com/s/jp7s9l34sf2jnc6.1-6.2-Semisimple-LAs-20181113.pdf?dl=0</a>  Article: "The greatest mathematical paper of all time" on Wilhelm Killing by A.J. Coleman <a href="http://www.math.umd.edu/~jda/744/coleman.pdf">http://www.math.umd.edu/~jda/744/coleman.pdf</a>
Th Nov 15	§6.3 Cartan subalgebras and the Root Space Decomposition	Homework #6 on Ch 5 due (55) 5.1.1; (56) 5.1.2; (57) 5.1.5(a,b); (58) 5.1.5(c,d); (59) 5.1.6*; (60) 5.2.6; (61) 5.3.1; (62) 5.3.5; (63) 5.4.7(a,b); (64) 5.4.7(c,d); (65) 5.5.1; (66) (read 5.5.2) 5.5.3;  ** Weimin Jiang spotted an error at the end of part (b), so omit this. If you're curious, see the article of Martin-Prieto for instances of how the Lie subalgebra $W_{\geq -1}$ of the Witt algebra $W$ is used.	Lecture Notes: <a href="https://www.dropbox.com/s/9um2hv9ze157xvz/6.3-6.4-Cartan-Subalgebras-Root-Space-20181115.PDF?dl=0">https://www.dropbox.com/s/9um2hv9ze157xvz/6.3-6.4-Cartan-Subalgebras-Root-Space-20181115.PDF?dl=0</a>  Article: "Extending Representations of $sl(2)$ to Witt and Virasoro Algebras" by Francisco J. Plaza Martin and Carlos Tejero Prieto <a href="https://link.springer.com/content/pdf/10.1007%2Fs10468-016-9650-3.pdf">https://link.springer.com/content/pdf/10.1007%2Fs10468-016-9650-3.pdf</a>
T Nov 27	§6.4 Classical Lie algebras Chapter 7 towards Theorem 7.13 and Classification of simple Lie algebras /C		Lecture Notes: <a href="https://www.dropbox.com/s/lapab3ujf5k5iza/6.4-7-Cartan-Subalgebras-Root-Space-20181127.pdf?dl=0">https://www.dropbox.com/s/lapab3ujf5k5iza/6.4-7-Cartan-Subalgebras-Root-Space-20181127.pdf?dl=0</a>
Th Nov 29	Chapter 8: Reps of Semisimple Lie algs §§8.1.1, 8.1.3, 8.1.4, 8.2, 8.3.1 (briefly), 8.3.2, 8.4.1 (briefly)		Lecture Notes: <a href="https://www.dropbox.com/s/d77qcs7b089npeml/8-Reps-SS-Lie-Algs-20181129.pdf?dl=0">https://www.dropbox.com/s/d77qcs7b089npeml/8-Reps-SS-Lie-Algs-20181129.pdf?dl=0</a>
T Dec 4	Chapter 9: Coalgebras, Bialgebras, and Hopf Algebras §§9.1.1-9.1.4, 9.1.6 (briefly), 9.2.1, 9.2.3 (briefly), selection of 9.3		Lecture Notes: <a href="https://www.dropbox.com/s/smxwv5cccn43t8f/9-Coalgs-Bialgs-HopfAlgs-20181204.pdf?dl=0">https://www.dropbox.com/s/smxwv5cccn43t8f/9-Coalgs-Bialgs-HopfAlgs-20181204.pdf?dl=0</a>
Th Dec 6	Chapter 12: Finite-dim'l Hopf Algebras towards Frobenius structure in §12.1.3; Semisimplicity towards Maschke's theorem in §12.3.1 Why care about Hopf algebras? Part I	Homework #7 on §5.7 and Ch 6-8 due (67) 5.7.3; (68) 5.7.4; (69) 5.7.5; (70) 5.7.9; (71) 6.1.2; (72) 6.2.1; (73) 6.3.1; (74) 8.1.1; (75) 8.2.2;	Lecture Notes: <a href="https://www.dropbox.com/s/azcrvai7z70qtou/12-FiniteDimHopfAlgs-20181206.pdf?dl=0">https://www.dropbox.com/s/azcrvai7z70qtou/12-FiniteDimHopfAlgs-20181206.pdf?dl=0</a>
T Dec 11	Why care about Hopf algebras? Part II On Monoidal Categories: Purpose, Structure, and Examples (based on previous material and more) (Instructor Notes, not in text)		Lecture Notes: <a href="https://www.dropbox.com/s/pnx6ex7t17uvfj1/Monoidal-Categories-20181211.PDF?dl=0">https://www.dropbox.com/s/pnx6ex7t17uvfj1/Monoidal-Categories-20181211.PDF?dl=0</a>
Summary	7 classes on (reps of) Algebras 10 classes on reps of Groups 9 classes on (reps of) Lie Algebras 3 classes on (reps of) Hopf Algebras		