18.701 SUBJECT OUTLINE

This outline may be revised during the semester.

1. Wednesday, September 4: General Linear Group, Groups
   *Review square systems 1.2.21.*
   Read: Ch 1, Sec 1-4; Ch 2, Sec 1-2
   Exercises: Ch 1, 1.7, 3.4, 4.6; Ch 2, 1.3, 2.3

2. Friday, September 6: Symmetric Group, Subgroups
   *Concentrate on the Symmetric Group.*
   Read: Ch 1, Sec 5, Ch 2, Sec 2
   Exercises: Ch 1, 5.1, 5.4; Ch 2, 2.4, 2.5

3. Monday, September 9: Subgroups of \(\mathbb{Z}^+\), Cyclic Groups
   *Review greatest common divisor.*
   Read: Ch 2, Sec 3-4
   Exercises: 3.1, *important*: 4.4, 4.5

4. Wednesday, September 11: Homomorphisms
   *We won't go over equivalence relations and partitions in class.*
   Read: Ch 2, Sec 5-7
   Exercises: 5.3, 6.6, 7.1

5. Friday, September 13: Cosets
   Read: Ch 2, Sec 8
   Exercises: 8.4, 8.6, 8.7, 8.10

6. Monday, September 16: Correspondence Theorem
   Read: Ch 2, Sec 10
   Exercises: 9.7, 10.1, 10.3, 10.5

7. Wednesday, September 18: Quotient Groups
   *We won't go over product groups in class.*
   Read: Ch 2, Sec 11-12
   Exercises: 11.3, 11.4, 12.1, 12.5

Friday, September 20: **Holiday**

8. Monday, September 23: Computation with Bases
   *The main difficulty here is notational.*
   Please learn the conventions, as in 3.4.2, 3.4.3, 3.4.14, 3.4.19.
   Read: Ch 3, Sec 4-5
   Exercises: 4.1, 4.8, 5.2, 5.4 (*Numbers refer to Sections 4 and 5.*)

9. Wednesday, September 25: Dimension Formula
   *We'll go fast here.*
   Read: Ch 4, Sec1-3
   Exercises: 1.3, 1.4, 2.1, 2.4
10. Friday, September 27: Eigenvectors
   *Ditto.*
   Read: Ch 4, Sec 4-5
   Exercises: 4.2, 5.3, 5.10, 6.4

11. Monday, September 29: Diagonal and Jordan Forms
   *Understand the statement of Jordan Form.*
   *Don’t worry too much about the proof.*
   Read: Ch 4, Sec 6-7
   Exercises: 6.10, 7.1, 7.3, 7.6

12. Wednesday, October 2: Isometries
   *We’ll skip Chapter 5 for now, except for rotations.*
   Read: Ch 6, Sec 1-3
   Exercises: 3.1, 3.2, 3.6

13. Friday, October 4: **First Quiz**

14. Monday, October 7: Rotations
   *We won’t go over Section 2 in class.*
   Read: Ch 5, Sec 1-2
   Exercises: 1.1, 1.2, 1.3, 2.1

15. Wednesday, October 9: Discrete Groups of Isometries
   *Learn the distinction between points and vectors.*
   *The point group operates on vectors, not on points.*
   Read: Ch 6, Sec 4-5
   Exercises: 4.3, 5.2, 5.3, 5.6

16. Friday, October 11: Discrete Groups, cont.
   Read: Ch 6, Sec 6
   Exercises: 5.11, 6.1, 6.3

   **Monday, October 14: Columbus Day, Holiday**

17. Wednesday, October 16: Group Operations
   *Most important are: the counting formula and the operation on cosets.*
   Read: Ch 6, Sec 7-9
   Exercises: 7.2, 7.4, 8.3, 9.6

18. Friday, October 18: Finite Rotation Groups
   *Learn the description of group operations in 6.11.3.*
   Read: Ch 6, Sec 10-12
   Exercises: 10.1, 12.3, 12.5

19. Monday, October 21: Class Equation
   *Concentrate on 7.2.2 - 7.2.7.*
   Read: Ch 7, Sec 1-2
   Exercises: 2.1, 2.5, 2.7, 2.17
20. Wednesday, October 23: Sylow Theorems
*Learn to use these theorems.*
Read: Ch 7, Sec 3, Sec 7
Exercises: 3.1, 7.3, 7.4a, 7.5a

21. Friday, October 25: Icosahedral Group
Read: Ch 7, Sec 4
Exercises: 4.1, 4.2, 4.3, 4.4

22. Monday, October 28: Applications of the Sylow Theorems
Read: Ch 7, Sec 8
Exercises: 7.10, 8.1, 8.4

23. Wednesday, October 30: Alternating Group
Read: Ch 7, Sec 5
Exercises: Ch 6, 11.9; Ch 7, 5.2, 5.3

24. Friday, November 1: Todd-Coxeter Algorithm
*Concentrate on Section 11. Give Sections 9,10 a quick reading.*
Read: Ch 7, Sec 9-11
Exercises: 9.2, 10.5, 11.3 a,e

Read: Ch 7, Sec 9-11
Exercises 11.2, 11.4, 11.5

26. Wednesday, November 6: Second Quiz

27. Friday, November 8: Symmetric and Hermitian Forms
*It takes a while to get used to Hermitian forms.*
Read: Ch 8, Sec 1-3
Exercises: 3.2, 3.3, 3.4

28. Wednesday, November 13: Orthogonality
*Treat orthogonality algebraically.*
Read: Ch 8, Sec 4 through 8.4.10.
Exercises: 4.5, 4.9, 4.21

29. Friday, November 15: Projection Formula
*The projection formula is very important.*
Read: Ch 8, Sec 4-5
Exercises: 4.2, 4.9, 4.15

Monday, November 11: Veteran’s Day, Holiday
30. Monday, November 18: Euclidean and Hermitian Spaces
*Learnt the characterizations of different kinds of operators in 8.6.3.*
Read: Ch 8, Sec 5
Exercises: 5.4, 5.5, 5.6

31. Wednesday, November 20: Spectral Theorem
Read: Ch 8, Sec 6
Exercises: 6.3, 6.6, 6.9, 6.14, 6.21

32. Friday, November 22: Quadrics
*Understand the cone $Q$, 8.7.16.*
Read: Ch 8, Sec 7
Exercises: 7.1, 7.2

33. Monday, November 25: Special Unitary Group $SU_2$
Read: Ch 9, Sec 1-3
Exercises: Ch 9, 2.1, 3.4

34. Wednesday, November 27: Rotation Group $SO_3$
*Review differential equations and the matrix exponential, Ch 5, Sect 4-5.*
Read: Ch 5, Sec 4; Ch 9, Sec 4
Exercises: Ch 5, 4.1a,c,d, 4.4; Ch 9, 4.1, 4.2

Friday, November 29: **Thanksgiving, Holiday**
*Please read Ch 8, Sect 7 and Ch 9, Sect 2 during the break.*

35. Monday, December 2: One-Parameter Groups
Read: Ch 9, Sec 5
Exercises: 5.5, 5.7,

36. Wednesday, December 4: One-Parameter Groups, cont.
Exercises: 5.10, 7.3

37. Friday, December 6: **Third Quiz**

38. Monday, December 9: Lie Algebra
*The Jacobi Identity is confusing at first.*
Read: Ch 9, Sec 6-7
Exercises: 6.1, 6.2, 6.3

39. Wednesday, December 11: Simple Groups
Read: Ch 9, Sec 8
Exercises: 7.7, 8.1, 8.5