# MATH 220 List of Possible Topics **Section 904**

31. Transcendental Numbers

32. Bernoulli Numbers

33. Fractal patterns

34. Fibonacci Numbers and Golden Ratio

35. Pascal's Triangle and Fibonacci Numbers

36. Error-correcting codes, especially linear or matrix codes

37. Two Principles of Counting (The Pigeonhole Principle and The Inclusion-Exclusion Principle)

38. The Tower of Hanoi

39. Euler Characteristic

40. Exploring Graph Theory: The Five Color Problem. ( Remark: All planar graphs can be colored using at most Five colors so that no two countries with a common borderline have the same color. Actually four colors are enough but that is beyond this course.)

41. Exploring Graph Theory: The Königsberg Bridge Problem. .

42. Sphere packing problem (Kepler's conjecture).

43. Latin Squares (note: Latin squares were first used in agricultural experiments)

44. Infinity (Hilbert's discussion of the "Grand Hotel" is a good starting point for this topic)

45. Ciphers or cryptography (secret codes)

46. Game theory and the Prisoner's Dilemma

47. Platonic solids

48. Crystal structures and symmetry

49. Tilings (e.g., the chess problem of the knights)

50. Knots and Braids

51. Groups

52. Little Fermat's theorem and RSA codes

53. Democratic elections and Arrow theorem

54. Finite Automata (including the Game of Life)

55. Göedel Incompleteness Theorem

56. Fermat's Last Theorem

57. The Riemann Hypothesis

58. The axiom of choice.

59. Proofs of Impossibility (Classical Greek problems)

60. The P versus NP problem