Content of CMSC/MATH 858R
Ramsey Theory and its "Applications"
`http://www/cs.umd.edu/~gasarch/858/S18/S18.html`

Overview: Ramsey Theory is a branch of combinatorics having to do with colorings and patterns. Here is a sample theorem: *for all 2-colorings of the natural numbers there exists arbitrarily long monochromatic arithmetic sequences (arithmetic sequences are equally spaced, like 11,14,17,20,23,27).* In this course we state and prove many such theorems and also "apply" them.

1. **The infinite Ramsey Theorem** APPLICATION to Proving Programs correct, well-quasi ordering, Canonical Ramsey Theorem. APPLICATION to Geometry.
2. **The finite Ramsey Theorems** Upper and lower bounds on the Ramsey Numbers. "APPLICATIONS" to lower bounds on various models of computation, the Erdos-Szekeres theorem in geometry, logic, Sociology, History.
3. **The Large Ramsey Theorem** "APPLICATION" to logic.
4. **Van Der Waerden's Theorem** Multidim VDW theorem, upper and lower bounds on VDW numbers. "APPLICATION" to Number Theory, "APPLICATION" to Multiparty Comm Complexity, "APPLICATION" to Diag-queens problem.
5. **Roth's Theorem for** $k = 3$ (the combinatorial proof by Szemeredi).
6. **Grid Colorings**
7. **Rado's theorem**
8. **Hales-Jewitt Theorem** "APPLICATION" to Ramsey Theory (really!). "APPLICATION" to comunication complexity.
9. **Polynomial VDW theorem** "APPLICATION" to graph theory.