Objective:
To develop an understanding of the design & implementation of game theoretic mechanisms to counteract against the challenges in wireless network and make wireless networking more efficient.

Course Description:
Wireless Networking and Mobile Computing are fast emerging as dynamic field of research. The visionary demands for ubiquitous access to information (anytime, anywhere) with "untethered" communication have introduced new challenges and new constraints in this emerging area. Future generation wireless networks will consist of intelligent radio devices, capable to sense the environment and effectively adjust their transmission parameters according to the current local channel conditions and QoS specifications. These devices will opportunistically use the spectrum, while their local resource management choices (selecting the transmission rates, transmission powers, access method, route to final destination for a multihop network, etc.) will greatly influence/conflict the performance of the other users in the network.

The course introduces the students to the fundamental concepts of Game Theory and demonstrates the use of these concepts in future generation wireless networking research. Game theory is the discipline aimed at modeling scenarios in which rational agents have to make specific decisions that have mutual and possibly conflicting consequences. In the recent time, game theory has played a vital role in the understanding of computer and communication networks and providing insights into questions such as allocation of network resources, analysis and effects of competitive and/or cooperative agents, wireless network protocols, network dynamics, wireless security, performance optimization, and network traffic and topology.

An important component of this course will be the research project and presentation, which will give the students the opportunity to apply their knowledge to design game theoretic solutions for specific wireless networking applications & issues.
Course Curriculum:
The following is tentative course curriculum.

The focus is on covering various aspects of Non-cooperative and cooperative Game Theory that would be instrumental in studying conflict/selfish/malicious behaviors in various networks. Topics of interest would include (but not limited to) Wireless Network Formation & Network Design, Cognitive Radio, Conflict in Dynamic Spectrum Access, Pricing, Routing, Medium Access Control, Wireless Security, Power Control, Distributed Networks (e.g., ad hoc and sensor networks) etc.

Tentative Syllabus:


Part II: Applications for wireless networks: Cognitive Radio, Dynamic Spectrum Access, Conflict management, Denial of service attacks, Covert Communications, Routing, Dynamic channel allocation, Power control, Link adaptation, General game theoretic framework for cooperation/non-cooperation in ad hoc and sensor networks.

Texts:

Required textbook:
- There is no required text book. Slides and reading list from current articles from journals, magazines and other websites will be provided to the students and will be used in the class extensively.

Reference Books:

Statements:

- The course materials will be posted at the WebCampus. Students are encouraged to share articles, demos, web pages, and news events that are relevant to course.

- The organization of the course will evolve as the semester progresses. I’m quite confident that it will be challenging but a fun course.

- Presentation slides will be available at the WebCampus website. I will try to put them up before each class meeting but no guarantees on that.

- Class participation in terms of asking questions is highly encouraged. Please do not be afraid to ask questions no matter how simple you might think the answer could be. This type of interaction helps improve the effectiveness of the class and breaks the monotony.

- Unless instructed otherwise, use of electronic devices except laptops are not allowed during lectures and exams.
• Students are encouraged to bring articles, demos, web pages, news events, etc. that are relevant to course topics to the attention of the instructor. The success of the course depends on everyone in the class engaging the material and bringing energy, enthusiasm, and intellect to class activities.

• Attendance at all class meetings is mandatory and will affect your grade. You should arrive on time and be prepared to discuss the session's topic. The underlying notion of the class is interaction, not passivity. The success of the course depends on everyone in the class engaging the material and bringing energy, enthusiasm, and intellect to class activities.

• There will be four in-class quizzes. The lowest graded one will not affect your overall grade. Exact date for some of these quizzes will not be exposed beforehand. These quizzes will be open book/notes and extremely time-constrained, i.e., 10-15 mins. Questions in these quizzes will be designed to give you an opportunity to test and affirm your knowledge of the course content.

• There will be one midterm exam and one final exam. You should plan on taking the exams on the scheduled times. No late/early exams unless in case of an emergency situation such as health emergency or similar unavoidable situations and you need to provide convincing documentation for it. The exams will be closed books and closed notes but a single page cheat sheet (double side, letter) is allowed. No calculators (unless otherwise stated) and no other electronic devices such as laptops, cell phones, beepers, etc. should be used during the exam.

• Assignments and exams must be prepared strictly individually. Copying from each other or from other sources is considered as cheating. Any form of cheating such as plagiarism or ghostwriting will incur a severe penalty, usually failure in the course. Please refer to the UNR policy on Academic Standards.

• This class may be videotaped or audio recorded only with the written permission of the instructor. In order to accommodate students with disabilities, some students may have been given permission to record class lectures and discussions. Therefore, students should understand that their comments during class may be recorded.

• If you have a disability for which you will need to request accommodations, please contact the instructor or someone at the Disability Resource Center (Thompson Student Services - 101) as soon as possible.

• Academic Success Services: Your student fees cover usage of the Math Center (784-4433 or www.unr.edu/mathcenter) and Tutoring Center (784-6801 or www.unr.edu/tutoring). These centers support your classroom learning; it is your responsibility to take advantage of their services. Keep in mind that seeking help outside of class is the sign of a responsible and successful student.

**Student Assessment:**
This is a tentative grading division and scale. Both grading policy and scale are subject to change.

- Project & Presentations: ~ 40%
- Homework assignments: ~ 15%
- In-class Quiz: ~5%
- Mid-term exam: ~ 20%
- Final exam: ~20%
**Grading Scale**

- **A**: 85 and above
- **B**: 75 and above but below 85
- **C**: 65 and above but below 75
- **D**: 50 and above but below 65
- **F**: 0 - 50 (or caught cheating)

**Important Note:** You will have one week to appeal for your grades after the graded assignments/tests are returned. So, please keep this in mind if you think that there is a problem/issue with the grading of your work.

**Project:**

- Project (term paper) is your own research paper chosen from any topic within the area of this course. It should reflect your original research and can be theoretical analysis, design of protocols, methodology, implementation guidelines etc. and will be submitted to a conference or journal before the end of the semester. (Follow the format of papers from ACM/IEEE, max 10/12 pages, double column). This term project includes a final presentation to the class. You can choose to do the term project individually or collaborate with another colleague.

**Paper Review & Presentation:**

- There will be two paper review presentations (before & after midterm exam) in the class by the students. Each student will be assigned a topic and a certain set of papers, which the student will review and present the findings.

**ABET Criteria:**

ABET Accreditation Criterion 3 Program Outcomes that are relevant to this course are:

1. An ability to apply knowledge of computing, mathematics, science, and engineering.
2. An ability to design and conduct experiments, as well as to analyze and interpret data.
3. An understanding of professional, ethical, legal, security and social issues and responsibilities.
4. An ability to communicate effectively with a range of audiences.
5. Broad education necessary to analyze the local and global impact of computing and engineering solutions on individuals, organizations, and society.
6. A knowledge of contemporary issues.
7. An ability to use current techniques, skills, and tools necessary for computing and engineering practice.