

**ECE8863: COGNITIVE RADIO NETWORKS**  
**Spring 2014**  
**MIDTERM EXAM: APRIL 2, 2014**

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- \* PUT A CODEWORD NEXT TO YOUR NAME!!!
- \* THIS IS AN OPEN BOOK EXAM (EVERYTHING ALLOWED EXCEPT LAPTOPS AND CELL PHONES)
- \* DURATION 75 MINUTES
- \* ANSWER THE QUESTIONS RIGHT TO THE POINT;
- \* AVOID LONG EXPLANATIONS; COUPLE SENTENCES WILL BE ENOUGH AS LONG AS THEY ARE CORRECT!!

**QUESTION 1. (40 points; 5 points each question)**

- a) What are the major differences between spectrum sensing methods in infrastructure-based networks and in ad-hoc networks?
- b) What are the major two problems faced by the transmitter detection (sensing) techniques for spectrum sensing?
- c) Although cyclostationary feature detection has all the advantages for sensing, researchers still try to find new sensing techniques. Why?
- d) What are the advantages of cyclostationary feature detection compared to matched filter detection?
- e) What are the shortcomings of compressed spectrum sensing?
- f) What was the problem with the Interference Temperature Management?
- g) Why is the spectrum sensing eliminated from TV white spaces?
- h) What are the gains (give 4 reasons) of cooperative sensing and downsides (give 2 reasons)?

**QUESTION 2: (18 points; 6 points each)**

- a) In the spectrum decision framework for long term quality variations and PU appearance cases we go back to Admission Control and for short term fluctuations we go back to spectrum sharing only. Why? What is the gain of this? Why don't we go to admission control in both cases?
- b) What is the difference between Single and Multiple User Selection in Spectrum Decision?
- c) What are the objectives of the Spectrum Decision framework of Lee/Akyildiz for Real-Time traffic and Best Effort traffic?

**QUESTION 3: (42 points; 7 points each)**

- a) Why is One Dimensional Based Auction with Pricing based on SINR or Power?
- b) What are the major differences between the papers: Auction based Spectrum Sharing and Interference Compensation Based Spectrum Sharing although both papers are from the same authors, Huang et.al.?
- c) Heng and Zhao introduced 5 rules for their device centric approach. What is the major difference between these 5 rules?
- d) What are the major differences between the LOCAL BARGAINING SCHEME and DEVICE CENTRIC APPROACH, although both papers from the same authors?
- e) Belief Assisted pricing is also developed for CR ad hoc networks as the device centric approach? What are the major differences between them?
- f) Competitive Equilibrium is a well-known approach for the optimal outcomes from economic models. However, the authors did not use that approach and suggested a multistage model. But they also did not use that multistage model and suggested a belief assisted pricing? Why all these steps?