III. CATALOG DESCRIPTION Limit to 50 words EXACTLY as you want it to appear in the catalog; include prerequisites, co-requisites, and other restrictions.

An introduction to the operation of financial markets in the U.S. economy, emphasizing market instruments and the use of these instruments by various financial institutions and market participants. Prerequisites: junior standing; MATH 104 or 250; ECON 200, ECON 201 or permission of the instructor. ECON 305 is recommended.

IV. RATIONALE or JUSTIFICATION: If course change or deletion—please provide reasons for change(s) to or deletion of a course. If a new course—briefly address the goals/objectives for the course, how the course supports a major or minor program, etc. For non-major courses address how the course supports the liberal arts tradition and the mission of the institution.

We are removing one sentence from the old description: “The final week of the course is spent attending seminars at various money-center financial institutions and markets.” The Department of Economics & Finance would like to offer the course without having to make it a travel course.

V. STUDENT LEARNING OUTCOMES and ASSESSMENT

<table>
<thead>
<tr>
<th>Student Learning Outcomes</th>
<th>Assessment Method and Performance Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>What will students know and be able to do when they complete the course?</td>
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</tr>
<tr>
<td>1.</td>
<td></td>
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<tr>
<td>2.</td>
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<tr>
<td>3.</td>
<td></td>
</tr>
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<td>4.</td>
<td></td>
</tr>
</tbody>
</table>

How does this course align with the student learning outcomes articulated for the major, program, or general education? What program-level outcome or outcomes does it support? Is the content or skill introduced, reinforced, or demonstrated in this course?
FACULTY CURRICULUM COMMITTEE COURSE FORM

Contact Name: Calvin Blackwell    Email: blackwellc@cofc.edu    Phone: 953-7836

Department or Program Name: Economics & Finance    School name: Business

Course Prefix, Number, and Title: ECON 350: Financial Markets in US Economy

I. CATEGORY OF REVIEW (Check all that apply)
(Note: For changes to course, if you check more than two separate changes, you must create a new course.)

NEW COURSE     CHANGE COURSE     DELETE COURSE

☐ New Course (attach syllabus)   ☐ Change Number   ☐ Re-activate Course
☐ Change Number   ☐ Change Title   ☐ Delete Course
☐ Change Title   ☐ Change Credits/Contact hours
☐ Change Credits/Contact hours   ☐ Prerequisite Change
☐ Prerequisite Change   ☐ Edit Description
☐ Approve for Cross-listing (attach rationale and written permission from relevant department)
☐ Intended to fulfill a General Education requirement (new courses only). If this box is checked, the course must also be submitted for review by the General Education Committee using this form.

Date (Semester/Year) the course will first be offered:

What are the prerequisites AND OTHER RESTRICTIONS (e.g., class level, major, co-requisite, credit for a mutually exclusive course)?

Will this course be added to the Degree Requirements of a Major, Minor, Concentration or List of Approved Electives?

a) ☐ Yes    ☐ No

b) If yes, complete and attach the CHANGE DEGREE REQUIREMENT form(s) for each affected program. List the name(s) of each program affected below:

II. NUMBER OF CREDITS and CONTACT HOURS per week

A. Contact Hours

B. Credit Hours

Is this course repeatable? ☐ yes    ☐ no
If so, how many credit hours may the student earn in this course?
FACULTY CURRICULUM COMMITTEE COURSE FORM

Contact Name: Calvin Blackwell  Email: blackwellc@cofc.edu  Phone: 953-7836

Department or Program Name: Economics & Finance  School name: Business

Course Prefix, Number, and Title: ECON 324: Game Theory

I. CATEGORY OF REVIEW (Check all that apply)
(Note: For changes to course, if you check more than two separate changes, you must create a new course.)

NEW COURSE

- New Course (attach syllabus)

CHANGE COURSE

- Change Number
- Change Title
- Change Credits/Contact hours
- Prerequisite Change
- Edit Description

DELETE COURSE

- Re-activate Course
- Delete Course

- Approve for Cross-listing (attach rationale and written permission from relevant department)

- Intended to fulfill a General Education requirement (new courses only). If this box is checked, the course must also be submitted for review by the General Education Committee using this form.

Date (Semester/Year) the course will first be offered: Fall/2013

What are the prerequisites AND OTHER RESTRICTIONS (e.g., class level, major, co-requisite, credit for a mutually exclusive course)?

junior standing, MATH 104 or 250, MATH 105 or 120, ECON 200, ECON 201 or permission of instructor.

Will this course be added to the Degree Requirements of a Major, Minor, Concentration or List of Approved Electives?

a)  □ Yes  ■ No

b) If yes, complete and attach the CHANGE DEGREE REQUIREMENT form(s) for each affected program. List the name(s) of each program affected below:

II. NUMBER OF CREDITS and CONTACT HOURS per week

A. Contact Hours

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Lab</th>
<th>Seminar</th>
<th>Ind. Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. Credit Hours 3

Is this course repeatable? □ yes ■ no  If so, how many credit hours may the student earn in this course?
VII. IMPACT ON EXISTING PROGRAMS and COURSES: Please briefly document the impact of this new/changed/deleted course on other programs and courses; if deleting a course—list all programs that include the course; if adding/changing a course—explain any overlap with existing courses in the same or different departments.

None.

VIII. COSTS ASSOCIATED WITH THE ACTION REQUESTED: List all of the new costs or cost savings, (including new faculty/staff requests, library or equipment, etc.) associated with the action requested.

None.

IX. APPROVAL AND SIGNATURES

1. Signature of Department Chair or Program Director:

   [Signature]

   Date: 11/8/11

2. Signature of Academic Dean:

   [Signature]

   Date: [Date]

3. Signature of Provost:

   [Signature]

   Date: [Date]

4. Signature of Curriculum Committee Chair:

   [Signature]

   Date: [Date]

5. Signature of Faculty Senate Secretary:

   [Signature]

   Date: [Date]

Date Approved by Faculty Senate: [Date]

Following Senate approval, the Faculty Senate Secretary will forward the entire packet to the Registrar.
III. CATALOG DESCRIPTION

Limit to 50 words EXACTLY as you want it to appear in the catalog; include prerequisites, co-requisites, and other restrictions.

Introduction to game theory and its applications to economics. Topics: strategic and extensive form games, dominant strategies, Nash equilibrium, subgame-perfect equilibrium, Bayesian equilibrium, and behavioral game theory.

Prerequisites: junior standing, MATH 104 or 250, MATH 105 or 120, ECON 200, ECON 201 or permission of instructor.

IV. RATIONALE or JUSTIFICATION: If course change or deletion—please provide reasons for change(s) to or deletion of a course. If a new course—briefly address the goals/objectives for the course, how the course supports a major or minor program, etc. For non-major courses address how the course supports the liberal arts tradition and the mission of the institution.

The addition of this course to the economics major helps to fill a gap in our current curriculum. Game Theory has been a part of economics since the 1950s. Modern economic theory builds heavily on game theory, and this is illustrated by the fact that a number of its early contributors have been awarded Nobel prizes for their work. Most large economics departments have at least one course in game theory.

This course addresses several key components to both the mission statement to the Department of Economics & Finance and the School of Business. This course directly incorporates four of the learning goals outlined by the School of Business:

Communication Skills: Students will demonstrate the ability, via both written and spoken word, to effectively present, critique and defend ideas in a cogent, persuasive manner

Global Civic Responsibility: Students will be able to identify and define social, ethical, environmental and economic challenges at local, national and international levels. Students will also be able to integrate knowledge and skills in addressing these problems.

Intellectual Innovation and Creativity: Students will be able to demonstrate their resourcefulness and originality in addressing extemporaneous problems.

Synthesis: Students will demonstrate the ability to integrate knowledge from multiple disciplines incorporating learning from both classroom and non-classroom settings in the completion of complex and comprehensive tasks.

V. STUDENT LEARNING OUTCOMES and ASSESSMENT

<table>
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</tr>
<tr>
<td>1. Students will understand the model of rationality assumed by Game Theory.</td>
<td>Students work weekly homework assignments, and take two mid-term exams and a final exam. (Sample assignments and exams attached at the end of this document.)</td>
</tr>
<tr>
<td>2. Students will understand the equilibrium concepts used in Game Theory.</td>
<td>Students work weekly homework assignments, and take two mid-term exams and a final exam.</td>
</tr>
<tr>
<td>3. Students will be able to use their knowledge of the prior two areas to model novel strategic interactions.</td>
<td>Students work weekly homework assignments, and take two mid-term exams and a final exam. In addition, students will complete a writing assignment in which they are asked to describe and analyze a novel strategic setting. (Sample writing assignment attached at the end of this document.)</td>
</tr>
</tbody>
</table>
How does this course align with the student learning outcomes articulated for the major, program, or general education? What program-level outcome or outcomes does it support? Is the content or skill introduced, reinforced, or demonstrated in this course?

Outcome 1 aligns with the School and Department’s learning goal of Global and Civic Responsibility by addressing the question of how “rational” people should behave in strategic situations. A variety of definitions of “rational” are discussed, as are their implications for ethical behavior.

Outcome 3 aligns with the School and Department’s learning goals of communication skills (the assignment is to write a paper that is partly graded on verbal ability), Intellectual Innovation and Creativity (the assignment challenges the student to generate his/her own analysis, and rewards creativity), and Synthesis (the assignment asks the student to incorporate learning from the entire semester and previous coursework in economics and/or mathematics).

VII. IMPACT ON EXISTING PROGRAMS and COURSES: Please briefly document the impact of this new/changed/deleted course on other programs and courses; if deleting a course—list all programs that include the course; if adding/changing a course—explain any overlap with existing courses in the same or different departments.

None.

VIII. COSTS ASSOCIATED WITH THE ACTION REQUESTED: List all of the new costs or cost savings, (including new faculty/staff requests, library or equipment, etc.) associated with the action requested.

None. The class has been taught as a special topics class for the past few years and does not require any additional resources.

IX. APPROVAL AND SIGNATURES

1. Signature of Department Chair or Program Director:

   Date: 11/8/11

2. Signature of Academic Dean:

   Date: 11/8/11

3. Signature of Provost:

   Date: 12/28/11

4. Signature of Curriculum Committee Chair:

   Date:

5. Signature of Faculty Senate Secretary:

   Date:

Date Approved by Faculty Senate: ________________________________

Following Senate approval, the Faculty Senate Secretary will forward the entire packet to the Registrar.
Suppose that you are a contestant on the quiz show "Jeopardy." At the end of the half hour contest (during Final Jeopardy) you have to make a wager on being able to answer a final question (that you have not yet been asked). If you answer correctly, your wager will be added to your winnings up to that point; otherwise the wager will be subtracted from your total. The two other contestants face identical decisions. Only one of you can win - how much should you wager?

This question can be answered by Game Theory, the study of strategic interaction. Any situation in which one person's actions can potentially influence another person's actions can be modeled as a game, making Game Theory a powerful means of understanding human behavior. With applications ranging from business to biology to political science to economics, Game Theory is an exciting, interdisciplinary field that has something to offer almost anyone.

Class Objective:

To introduce students to Game Theory and its applications in economics, business, political science, the law and everyday life. After taking this course, the student should:

- understand the model of rationality assumed by Game Theory;
- understand the equilibrium concepts used in Game Theory; and
- be able to apply basic Game Theory (economic) models to novel situations.

This class addresses the School of Business' learning goal of problem solving.
Policies

1. You should come to class. I lecture on material not covered in the textbook; you are responsible for all the information in both the lectures and the text. Most students attend class every day.

2. You must behave yourself while in class. I expect all students to behave appropriately while in the classroom. If you have a question, raise your hand and I will be more than happy to answer your question. I expect you to arrive for class on time and prepared. Classroom disturbance of any kind will not be tolerated - you impose a cost not only on yourself, but also upon your classmates when you disrupt my class. Please do not talk to your neighbors while I am lecturing. If you must carry a cell phone or pager, turn it off while you are in my class.

3. You must complete your assignments on time. No excuses! Problem set deadlines will not be extended for any reason! Most students submit all their assignments on time.

4. You must take the exams at the scheduled time. I want you to take the exams at the times they are scheduled. If you have any problems with the timing of tests, please notify me in advance. You must give me your excuse before the test begins. You can send me an email or leave me a message, but you must inform me of your absence prior to the test. Failure to provide a legitimate excuse prior to the exam will result in a grade of zero. If you have a legitimate excuse you will not take a makeup exam; instead I will re-weight your final exam to cover the exam missed and the final exam. Example: You miss Exam 1, which is worth 15% of the course grade. Normally the final exam is worth 35% of the course grade, but for you it will be worth (15% + 35%) = 50% of the course grade.

5. Cheating will be dealt with severely. All students are expected to follow to the College Honor Code and Code of Student Conduct (consult your student handbook if you need to review the codes.) Cases of suspected academic dishonesty will be reported directly to the Dean of Students. A student found responsible for academic dishonesty will receive a grade of XF in the course, indicating failure of the course due to academic dishonesty. The student may also be placed on disciplinary probation, suspended or expelled. Students can find the complete Honor Code and all related processes in the Student Handbook at http://studentaffairs.cofc.edu/honor-system/studenthandbook/index.php

6. All course materials will be available on WebCT. The website will contain copies of homework and paper assignments, practice questions for exams, and general class announcements.

7. Learning Disability. If there is any student in this class who has a documented learning disability and has been approved to receive accommodations through SNAP Services, please feel free to come by and discuss this with me during my office hours.

8. If you have a problem, you must express it to me in writing. If you have a "problem," you must provide the proper paperwork for me to solve it. A "problem" could be any of a number of things. Some examples: You have to miss the midterm exam because you are going out of town and you need an excused absence or you believe that I graded an assignment unfairly. In order to address your problem, I need to know the nature of the problem and your proposed solution to this problem. This information must all be in writing, using my "I have a problem..." form. I will need two (2) copies of this form. I will keep one for my own records and return one to you with my response. You may only appeal my decision with another problem form. For certain requests I require supporting documentation, e.g. doctor's excuse, court summons, etc. I will not consider any problem unless it is presented in this format. If you want to challenge a grade on an
assignment, you must explain which problems were graded incorrectly and why you should receive more credit.

Grading

I base your grade on four criteria:

- Knowledge of material covered in the textbook and in class
- Ability to apply knowledge
- Ability to relay that knowledge back to me
- Responsibility - assignments turned in on time, exams taken at the appropriate time.

Notice grades are only indirectly based on effort! Instead, your grade is based primarily on your competence with Game Theory.

I will give you a zero if you fail to take an exam (and do not have an appropriate excuse) on time or fail to turn in a problem set or paper on time.

The breakdown for points is as follows:

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Midterm Exams</td>
<td>15%</td>
<td>Each covers approximately one-third of the course material. See calendar for dates.</td>
</tr>
<tr>
<td>Final Exam</td>
<td>35%</td>
<td>Cumulative final exam. Longer version of midterm.</td>
</tr>
<tr>
<td>Homework Problem Sets</td>
<td>25%</td>
<td>Every Friday you will have a short (2-3 problems) homework assignment due. I will count the highest ten homework scores.</td>
</tr>
<tr>
<td>Applied Game Theory paper</td>
<td>10%</td>
<td>A 4-6 page paper analyzing and explaining a familiar &quot;natural&quot; phenomenon. Details will be provided later in the course.</td>
</tr>
</tbody>
</table>

Your class grade depends on the total amount of points you earn. I do not rule out a curve, but I promise that I never curve down, only up. Therefore the following scale shows sufficient but not necessary conditions for a particular grade:

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 - 90%</td>
<td>89 - 80%</td>
<td>79 - 70%</td>
<td>69 - 60%</td>
<td>Below 60%</td>
</tr>
</tbody>
</table>

Important Dates

<table>
<thead>
<tr>
<th>Date</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 October</td>
<td>EXAM 1</td>
</tr>
<tr>
<td>11 October</td>
<td>FALL BREAK</td>
</tr>
<tr>
<td>8 November</td>
<td>EXAM 2</td>
</tr>
<tr>
<td>24 November</td>
<td>THANKSGIVING</td>
</tr>
<tr>
<td>26 November</td>
<td>THANKSGIVING</td>
</tr>
<tr>
<td>6 December</td>
<td>Paper due</td>
</tr>
<tr>
<td>11 December</td>
<td>FINAL EXAM, Noon to 3 p.m.</td>
</tr>
</tbody>
</table>
Note: I plan to cover approximately 12 of the 17 chapters in our text. Reading assignments will depend upon our pace - I will make regular announcements about the reading assignments. I expect you to have read the given assignment when you come to class.

Tips for Success

This class is about learning how to apply the tools of Game Theory. The single best way to learn this process is practice. In addition to assigned problem sets, the textbook provides many extra problems. I strongly suggest using them. You will soon discover that I am also very concerned that you learn the intuition behind why we engage in the procedures. So in addition to knowing how to work each type of problem, you should also understand why we do each type of problem.

If you are having trouble following the material in the course, you are encouraged to seek additional help early so that you do not fall behind. Do not wait until it’s too late. You may see me during my office hours or you may make an appointment for some other time. If your class schedule and/or work schedule makes it impossible for you to meet with me during my scheduled office hours, please let me know by sending a list of times that you are free to my email address. You may also drop by my office for extra help any time you feel it is necessary, but you might want to call first to make sure I'm in. Remember, your tuition pays for my time, so use it!

This is your course. You will find that I am extremely flexible with regard to many aspects of this class. I value your input and will use it to make the class better for you, so if there is anything that you feel will enhance your learning experience, please let me know.
I have a problem...

Name: ___________________________ Date: _________ ECON 360 Fall 2010

Directions: Fill out this form completely. Remember, you are trying to convince me to do something for you! Don't forget, you must submit 2 copies.

State the nature of your problem:

State your proposed solution to this problem:

Supporting documentation:

My decision:

Contract

Name: __________________________     Student ID#: ________________________

I have received a syllabus from Professor Blackwell for ECON 360. I understand and agree that I will follow all the policies listed in that syllabus, including but not limited to:

- I accept the attendance policy, which requires my presence in class at each meeting time, and for which there are no excused absences except in exceptional circumstances for midterm exams.
- I accept the responsibility to know of assignment deadlines, and not to ask for special treatment or favors.
- I understand that under no circumstances will late assignments be accepted after the posted deadlines.
- I understand that if I wish Professor Blackwell to respond to any of my requests, I must submit 2 copies of an appropriately completed I have a problem form.

I understand that in return for accepting these conditions, Professor Blackwell agrees to the following:

- To be prepared for each class with well-organized, meaningful material.
- To return all exams within five class periods after the assignment is submitted.
- To carefully consider all student requests made through the I have a problem form.
- To maintain current records so that each student may know at any time his or her grade status.
- To provide details of assignments at least one week before they are due.
- To maintain regular office hours and be available at other times for students as requested.
- To provide a meaningful and productive learning experience for those students willing to do the work.

Signed: __________________________     Date: ____________
Instructions: Answer each question as completely as you can. Show all relevant work. Label all graphs clearly. Remember, the quality of your answer’s explanation is as important as the correctness of the answer. Do not answer questions on this paper. Please be neat!

1) Jim’s Gin Mill and Tom’s Turkey Tavern compete for pretty much the same crowd. Each can offer free snacks during happy hour, or not. The profits are 30 to each tavern if neither offers snacks, but 20 to each if they both offer snacks, since the taverns have to pay for the snacks they offer. However, if one offers snacks and the other does not, the one who offers snacks gets most of the business and a profit of 50, while the other loses 20. Represent this game in normal form (i.e., draw the payoff matrix).

2) Consider the following game. Harry picks a number between 1 and 3. Sally then makes a guess as to Harry’s number. If Sally guesses correctly, she earns $5, otherwise she gets nothing. If Sally guesses incorrectly, Harry gets $5, otherwise he gets nothing. Model this situation in extensive form as a two-stage decision tree.

3) A prisoner is trying to escape from jail. He can attempt to climb over the walls or dig a tunnel from the floor of his cell. The warden can prevent him from climbing by posting guards on the wall, and he can prevent the con from tunneling by staging regular inspections of the cells, but he only has enough guards to do one or the other, but not both.
   a) What are the strategies and payoffs for this game? (Use ordinal measures like best, worst, etc.)
   b) Assume that both the prisoner and the warden make their decisions simultaneously. Draw the payoff matrix for this game.
   c) Assume the warden makes his decision first, and then the prisoner chooses second with complete knowledge of the warden's choice. Draw the game tree (i.e., extensive form) for this game.
Exam 1

Name: ___________________________ SID#: __________

Instructions: Answer each question as completely as you can. Show all relevant work. Label all graphs clearly. Remember, it is as important to explain your answer as it is to find the correct answer. For problems involving calculations, show all steps and work. Points are shown in brackets next to each question. The exam has 100 total points. Answer all questions in the space provided. Remember to put your name on the test.

1) [20] Provide the strategic form of the extensive form game below:

```
  Pl: -5  
PZ: -5  
P1: 20  
P2: 0   
P1: 0   
P2: 20  
P1: 2   
P2: 2   
```

```
P2
  Left
  P1: -5
  P2: -5

  Right
  P1: 20
  P2: 0

P1
  Down
  P1: 0
  P2: 20

  Left
  P1: 2
  P2: 2
```
2) [30] Two landowners live next to each other on the same side of a river. This river is prone to flood. Each landowner has a choice of two actions: build a levee to protect against floods, or not. If neither landowner builds a levee, then every 10 years their property floods. If both landowners build levees, then both are protected when the 10-year flood comes. If only one landowner builds a levee, the floodwaters simply go around the levee and both properties flood every 10 years. It costs each landowner 4 utils to build a levee. If the landowners both build levees, the 10-year flood does no damage. If a landowner's property is flooded, the landowner incurs a cost of 6 utils.

a) Provide the strategic form of this game (i.e., draw the payoff matrix).

b) What is/are the Nash equilibrium for this game? Explain.

c) Is this game more like a prisoner's dilemma or a stag hunt? Explain.
3) [20] Given the game below:

<table>
<thead>
<tr>
<th>Row</th>
<th>Column Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up</td>
<td>35, 30</td>
<td>50, 25</td>
</tr>
<tr>
<td>Down</td>
<td>40, 60</td>
<td>20, 25</td>
</tr>
</tbody>
</table>

a) Does the Row player have a dominant strategy? Explain.

b) What is the Nash equilibrium to this game? Explain.

4) [10] In a short paragraph, explain what is meant by the term "Schelling point."
5) [20] Given the game below:

<table>
<thead>
<tr>
<th>Row</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z</td>
<td>0,0</td>
<td>4,3</td>
<td>10,60</td>
<td>50,30</td>
<td>60,40</td>
</tr>
<tr>
<td>Y</td>
<td>10,4</td>
<td>5,5</td>
<td>60,40</td>
<td>80,25</td>
<td>20,5</td>
</tr>
<tr>
<td>X</td>
<td>100,15</td>
<td>80,10</td>
<td>70,30</td>
<td>60,10</td>
<td>50,20</td>
</tr>
<tr>
<td>W</td>
<td>80,10</td>
<td>30,50</td>
<td>60,10</td>
<td>15,8</td>
<td>30,100</td>
</tr>
<tr>
<td>V</td>
<td>90,12</td>
<td>50,60</td>
<td>10,10</td>
<td>25,3</td>
<td>32,64</td>
</tr>
</tbody>
</table>

Column

a) Find all of the Nash equilibria for this game. Explain.

Bonus:
[+2] If you had only one match and entered a COLD and DARK room, where there was an oil heater, an oil lamp and a candle, which would you light first?
1) [10] Create some games!
   a) In the matrix below put in payoffs such that the two players will face a stag hunt game.

<table>
<thead>
<tr>
<th></th>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Down</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   b) In the matrix below put in payoffs such that the two players are playing a game of pure coordination.

<table>
<thead>
<tr>
<th></th>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Down</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2) [15] Given the following game in extensive form:

a) What is the subgame perfect Nash equilibrium for this game? Explain.

b) Put this game in strategic (matrix) form.

c) Identify all of the Nash equilibria for this game.
3) [15] Given the game below:

<table>
<thead>
<tr>
<th></th>
<th>Column</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Left</td>
</tr>
<tr>
<td>Row</td>
<td>Up</td>
</tr>
<tr>
<td>Left</td>
<td>60, 40</td>
</tr>
<tr>
<td>Down</td>
<td>50, 50</td>
</tr>
</tbody>
</table>

a) Are there any pure-strategy Nash equilibria in this game? Explain.

b) Find the mixed-strategy Nash equilibrium for this game.
4) [15] Consider the $n$-Player threshold public good game. Each player starts the game with one token, and has a choice of two strategies: contribute the one token to the public good or not. If 50% or more of the players contribute, then all of the players earn 3 additional tokens, regardless of whether they contributed to the public good or not. If less than 50% of the players contribute, then the public good is not provided, and each player that contributed loses his/her token. Let the state variable for this game be the proportion of players contributing to the public good. In the diagram below, draw the payoff (the number of tokens) to each strategy as a function of the proportion of players contributing to the public good.

![Diagram](image)

a) If all players choose not to contribute to the public good, is this combination of strategies a Nash equilibrium? Explain.

b) If all players choose to contribute to the public good, is this combination of strategies a Nash equilibrium? Explain.

c) If 50% of all players choose to contribute to the public good (so that the good is provided), is this combination of strategies a Nash equilibrium? Explain.
5) [10] Given the game below:

<table>
<thead>
<tr>
<th></th>
<th>Column</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Left</td>
</tr>
<tr>
<td>Row</td>
<td>5, 5</td>
</tr>
<tr>
<td>Up</td>
<td></td>
</tr>
<tr>
<td>Down</td>
<td>10, 2</td>
</tr>
</tbody>
</table>

a) Suppose the game is played once. Find the Nash equilibrium. Explain.

b) Suppose this game were indefinitely repeated. The game has a 90% chance of being played again. A possible equilibrium could be as follows: Column plays 'Left' as long as Row plays 'Up,' but if Row ever plays 'Down,' Column plays 'Right' forever; Row plays 'Up' as long as Column plays 'Left,' but if Column ever plays 'Right,' Row plays 'Down' forever. Show that the Row player would have no incentive to deviate from this equilibrium.
6) [10] Software Inc. and Hardware Inc. are in a joint venture together. Each can exert either high or low effort, which is equivalent to costs of 30 or 0. Hardware moves first, but Software cannot observe his effort. Profits are split equally at the end, and the two firms are risk neutral. If both firms exert low effort, profits are 100. If both firms exert high effort, there is a 90% chance profits are 200 and a 10% chance profits are 100. If one firm exerts high effort and the other firm gives low effort, there is a 70% chance profits are 200 and a 30% chance profits are 100.

a) Put this game in matrix form (you can ignore Nature as a player and simply use expected profits).

b) Find the Nash equilibrium for this game. Explain.
7) [25] Given the game below:

<table>
<thead>
<tr>
<th>Row</th>
<th>Up</th>
<th>Down</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Column</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>6, 6</td>
</tr>
<tr>
<td>2, 1</td>
</tr>
<tr>
<td>Right</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>1, x</td>
</tr>
<tr>
<td>2, x</td>
</tr>
</tbody>
</table>

Suppose that x can take one of two values: 0 or 2, each with probability $\frac{1}{2}$.

a) Draw the extensive form of this game.
b) From the extensive form you drew above, create the matrix form of the game. Continue to use Row as the row player and Column as the column player.

c) What is the Bayes-Nash equilibrium for this game? Explain.

Bonus:
[2] Which weighs more: a pound of feathers or a pound of lead?
Use the tools and models we have developed in class to explain some pattern of behavior as the equilibrium to a game. Describe the parameters of the game (who are the players, what strategies can they choose among, what are their payoffs) and justify why your model captures the essential strategic interaction of situation. Explain how the pattern of behavior is an equilibrium to the game. If the game has multiple equilibria, explain which equilibrium is most likely and why.

A suggested outline of your paper:
1. Description of the pattern of behavior
2. Description of the game
3. Equilibrium analysis

You may use any pattern of behavior (no matter how trivial!) as long as it has some strategic interaction component. You may not use an example described in your text. Whatever pattern of behavior you analyze, it must be your own idea, not borrowed from your text or classmates. The originality of your idea is important!

Your paper must be typed, double-spaced, paginated, with reasonable margins (i.e. about an inch on all sides.) I expect your paper will be between four and six pages in length, including diagrams. Conventional punctuation, grammar and spelling are expected. Edit and proofread your paper! It would be useful to prepare a draft of your paper that can be edited and polished to be certain that it is coherent and concise. Finally, I want you to submit your paper by electronic mail (in Microsoft Word format). Send an email to me (blackwellc@cofc.edu) with your paper as an attached file. The subject heading of the email should be “Game Theory Paper” and you should name your file with your own name, last name first. An example: BlackwellCalvin.docx

You must work on this assignment yourself, without the help of any of your classmates. You may use the Writing Lab in the College Skills Lab in the Education Center for advice on improving your paper (and in fact, if you visit the writing lab I will give you one extra point on your paper.)

The paper you submit will be judged based on the evaluation sheet (on back) provided. Your paper will be evaluated primarily for your use of game theory to explain a real world phenomenon, but it is also important for your paper to be organized, clearly written and creative.

You must work independently on this project. Plagiarism is presenting another person's work as your own. Examples of plagiarism include copying another person's paper, restating ideas from a book or article without citing the article as the source, or copying more than seven words from a book or article without quotation marks and a citation of the source of the quotation. These examples do not exhaust the possibilities. Any example of presenting another person's work as your own is plagiarism.

Students who fail to turn in a paper by the end of class on December 6, 2010 will receive a grade of ZERO on their assignment.
<table>
<thead>
<tr>
<th>Possible Points</th>
<th>Score</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td>Phenomenon&lt;br&gt;Does the student clearly identify and explain the pattern of events or behavior observed? What is the pattern of events?</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Organization&lt;br&gt;Does the paper flow in a logical, coherent manner?</td>
</tr>
<tr>
<td>60</td>
<td></td>
<td>Analysis&lt;br&gt;Does the student use game theory to explain why this particular pattern of events occurs? Does the student properly identify the parameters of the game? Does the student correctly analyze the situation and identify the equilibrium? Does the student adequately explain why the equilibrium is an equilibrium?</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Prose Style&lt;br&gt;Is the writing lucid, error free, even graceful? Are there major problems of style, syntax, or spelling?</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>Creativity&lt;br&gt;Has the student, within the bounds of the assignment, shown unusual creativity in the selection and/or treatment of the subject? Has the creativity enhanced the assignment?</td>
</tr>
<tr>
<td>100</td>
<td></td>
<td>Total</td>
</tr>
</tbody>
</table>

Comments: