Course description

Modeling and Simulation

CS 313

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Course description / Modeling and Simulation

**Educational institution:** Princess Nora Bint Abdel Rahman University

**Faculty:** Computer and Information Sciences

**Department:** Computer Science

**A) Course specifications and general information**

1- **Course name and Number:** Discrete structures – CS 313

2- **Number of credits:** 3 (contact hours: lecture - 3, exercise – 1)

3 - **The program or programs in which the course is offered:**
The Bachelor of Computer and Information Science in computer science, information systems, networks and communication systems.

4 - **Name of faculty member responsible for the course:** One of the staff members of appropriate specialization to be assigned in time.

5- **Level or year in which the course is offered:** starting from Level 6

6- **pre-requisite course(s) (if any):** Senior standing + General statistics- MaSc261

7 - **Requirements associated with this course (if any):** None.

8- **Course teaching place if not in main campus:** None.

**B) Objectives**

1- **Brief description of basic learning outcomes:**

- Learn methodologies for modeling and simulation of complex systems
- Understand basic concepts of discrete-event simulation
- Being able to analyze the simulation output and validate it
- Understand the concept of random number generation and their validation
2 - Briefly describe any current plans being implemented to develop and improve the course (e.g.: the increasing use of materials and references that rely on information technology or the Internet, and changes in course content based on the results of new research in the field):

- Taking into account the following learning entities (e-Learning via networking, e-Learning software, collaborative learning, learning via problem-solving and decision-making, investigative learning, constructive learning).
- Periodic review of the course by the Commission on plans and schedules in the department.
- Update course content regularly on the basis of recent developments in the field.
- Keep pace with the rapid development in the field through the use of modern technologies.
- Update learning resources for the course on a regular basis.
- Comparison of course vocabulary with what is being presented in other local, regional and global departments.
- Access to relevant Web sites.

C) Course Description

1- Topics to be discussed (theoretical content):

This course will cover a comprehensive introduction to the modeling and simulation of real systems. The course include methodologies for simulation and modeling, statistical analysis of simulation input, random number generators and their validation, Markov chain and queuing theory.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Number of weeks</th>
<th>Contact hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to the course content, text book(s), reference(s) and course plane.</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Introduction to simulation and modeling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modeling Methodology</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Introduction to Queues and Simulation</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Statistical models</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Discrete-Event Simulation</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Random Number Generators</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Monte-Carlo Simulation</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>
### Course Description

**Randomness Tests – Goodness-of-fit** | 1 | 3
---|---|---
**Output Statistics** | 1 | 3
**Markov Chain** | 2 | 6
**Queuing Theory** | 2 | 6
**Network of Queues** | 1 | 3

**1- Topics to be discussed (practical content):**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Number of weeks</th>
<th>Contact hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming and Analysis of Random Number Generators</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Design of a discrete event simulator for M/M/1 Queues</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

**2 - Course components (total contact hours per semester):**

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Private lessons</th>
<th>Practical / Field / cooperative training or privilege for students in health specialties</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>-</td>
<td>15</td>
<td>-</td>
</tr>
</tbody>
</table>

**3 - Additional private study / expected learning hours by students in a week (expected to be an average for the semester not a specific requirement in each week):**

3 units of study (selected readings on topics from books and specialized scientific periodicals).

**4 - Development of learning outcomes in the domains or areas of learning**

For each learning domain shown below indicate:

- A brief summary of the knowledge or skills for which course is designed in order to develop them.
- Description of the learning strategies to be used to develop that knowledge or skills.
- Methods of student assessment used in the course to evaluate learning outcomes.

**A – Knowledge**

<table>
<thead>
<tr>
<th>1 - Description of the knowledge to be acquired:</th>
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</thead>
<tbody>
<tr>
<td>Students who successfully complete this course will be able to:</td>
</tr>
<tr>
<td>– Demonstrate methodologies for modeling and simulation of complex systems.</td>
</tr>
<tr>
<td>– Describe basic concepts of discrete-event simulation.</td>
</tr>
<tr>
<td>– Analyze the simulation output and validate it.</td>
</tr>
<tr>
<td>– Describe the concept of random number generation and their validation.</td>
</tr>
</tbody>
</table>

| 2 - Strategies for Education (teaching) to be used to develop that knowledge: |
| Interactive lecture, discussion and dialogue, collaborative learning, e-learning, guided discovery, brainstorming, problem solving, research / projects. |

| 3 - Methods of assessment of gained knowledge: |
| Written tests (objective and essay). |
| Practical tests. |
| Classroom assignments and homework. |
| Theoretical Research or an article. |
| Projects and presentations. |
| Participation in seminars. |

**B - Cognitive skills**

| 1 - Cognitive skills to be developed: |
| Skill originality, fluencyskill, flexibility skill, illustrationskill, descriptionskill, sentencingskill, conclusionskill, comparisonskill, problem-solving skill, generalizationskill. |

| 2 - Learning strategies used in the development of cognitive skills: |
| Lectures, discussion, brainstorming, problem solving, decision making, research and projects, survey and simulation. |
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#### 3- Methods of assessment of acquired cognitive skills:
- Written tests (objective and essay).
- Research.
- Projects and Practical research.
- Participation in seminars.

#### C - Inter-relations skills (personal) and responsibility

1 - **Description of the interpersonal skills with others, and the capacity to carry responsibility to be developed:**
- Skill of collaborative work in an environment of collective action.
- Collective decision-making skills.
- Skill of negotiation.
- Skill of effective communication.
- Skill to accept criticism from others.
- Skill to lead a group.
- Each individual carry the responsibility in implementing the tasks assigned to him and leading to work success.

2 - **Education strategies used to develop these skills and abilities:**
- Assignments individually and collectively.
- Group discussion.

3 - **Methods of assessment of students’ interpersonal skills and ability to take responsibility:**
- Evaluation of individual works periodically.
- Evaluation of collective works periodically.
- Personal interviews.
- Organized observation.
- Evaluation of colleagues.

#### D - communication skills, information technology, mathematical (numerical) skills:

1 - **Description of numerical skills and communication skills to be developed:**
- The ability to use computers and operating systems.
- The ability to use modern technologies in communication and communication and networking.
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- The use of information technologies to access, preserve, and process information.

2 - Education strategies used to develop these skills:
- Participation in conducting lectures.
- Practical training.
- Giving theoretical assignments.

3 - Methods of assessment of students’ communication skills, information technology, mathematical (numerical) skills:
- Research and reports.
- Presentations.
- Design lessons using information technology.
- Assignments Assessment.

E) Motor skills (if required)

1 - Description of the psychomotor skills to be developed in this area:
- Skill to operate and use computers and means of modern technology.
- The ability to choose the appropriate tools and use them in a correct way.

2 - Learning strategies used in the development of motor skills:
- Applications, training and guided discovery.
- Simulation and modeling.
- Research projects.
- Collaborative teaching.
- Presentations.

3 - Methods of assessment of students’ psychomotor skills:
- Method of modeling.
- Practical classroom applications.
- Performance assessment card.
- Observation.
4 - Schedule of Assessment Tasks according to which the students are evaluated during the Semester

<table>
<thead>
<tr>
<th>index</th>
<th>The nature of the evaluation function (e.g.: article, quiz, group project, etc.)</th>
<th>Due week</th>
<th>Assessment weight (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>First exam</td>
<td>Week 7</td>
<td>10%</td>
</tr>
<tr>
<td>2</td>
<td>Second exam</td>
<td>Week 12</td>
<td>15%</td>
</tr>
<tr>
<td>3</td>
<td>Theoretical assignments</td>
<td>Weeks 5 &amp; 10</td>
<td>5%</td>
</tr>
<tr>
<td>4</td>
<td>Practical assignments and quizzes.</td>
<td>Weeks 2, 4, 6, 8, 10, 12</td>
<td>5%</td>
</tr>
<tr>
<td>5</td>
<td>Practical project</td>
<td>Week 8</td>
<td>5%</td>
</tr>
<tr>
<td>6</td>
<td>Final exam (practical)</td>
<td>After Week 15</td>
<td>20%</td>
</tr>
<tr>
<td>7</td>
<td>Final exam</td>
<td>After Week 15</td>
<td>40%</td>
</tr>
<tr>
<td>Total:</td>
<td></td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

D) Support provided to students

Procedures or arrangements implemented to ensure the presence of faculty members to provide advice and guidance to the student when needed (specify the amount of time - office hours per week):
- Direct supervision by faculty member during practical training.
- Determination of the number of Office hours to which the faculty members are committed, and assure to be announced to the students.
- Web site with the means of communication.
- Academic Advising to help students in resolving any academic and study problems related to the course.

E) Learning resources

1 – The principal book(s) requested:
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2- Basic references:
- “PERFORMANCE EVALUATION LECTURE NOTES (METHODES, PRACTICE AND THEORY FOR THE PERFORMANCE EVALUATION OF COMPUTER AND COMMUNICATION SYSTEMS)” available online, By Jean-Yves Le Boudec, http://ica1www.epfl.ch/perfeval/lectureNotes.htm
- NS-2 Simulator, http://www.isi.edu/nsnam/ns/

3 - Books and references recommended (scientific journals, reports, etc.) (List is attached):

4 - Electronic Materials and Web sites, etc.:
- http://www.isi.edu/nsnam/ns/

5 - Other learning materials such as programs that run on computer, or professional standards or regulations:
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F) Required Facilities:
Determine the requirements of the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories and the availability of computers, etc.).

1 - Educational facilities (lecture rooms, laboratories, etc.):
- Classrooms for lectures which are featured to traditional education, e-learning, and equipped with a computer, display device, data show screen, ordinary blackboard, intelligent blackboard, integrated sound system, proper lighting system, and proper conditioning system.
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- Computer laboratory which includes a computer network, data server, computer for the supervisor, computer for each student, central printer, data show, show screen, and intelligent board.

2 - Computers:
- A computer for faculty member in the room and the laboratory.
- A computer for each student in the laboratory.

3 - Other resources (specify):
- Original copies of application programs and operating systems.

G) Assessment of the course and improvements:

1 - Strategies to get the student’s results and the education effectiveness:
- Analysis of students’ results.
- Observation during work.
- Students’ evaluations.
- Colleagues’ evaluations.
- Teacher’s achievements portfolio.
- Evaluation questionnaire filled by the students.
- Interview a sample of students enrolled in the course to take their opinions.

2 - other strategies used to evaluate the learning process, either by Mr. or by section:
- Self-assessment.
- External evaluation.
- Periodic review of course (the Commission of study plans).

3 - Operations to improve education:
- Taking into account the recommendations yielded from the internal review of the course.
- Guidelines about course teaching provided by the by study plans commission.
- Department Guidelines about faculty member performance on the basis of direct observation.
- Training and development.
- Workshops to improve the educational process.
4 - Verification of the levels of students’ achievements (for example: check exam correction or grades by independent faculty member for a sample work of female students, course lecturer periodically exchange correcting a sample of assignments or tests with another faculty member teaching the same course in other educational institution)
- Use of external reviewers from departments outside the university.

5 - Describe the arrangements and plans for periodic review of the effectiveness of the course and planning for improvement:
- Comparison of the course to its counterparts offered in similar departments.
- Periodic revision of course description by faculty member.
- Periodic revision of course description by the study plans and schedules Commission.
- Update learning resources related to the course to ensure that the course is kept up with developments in the field.
- Make use of statistical results of course evaluation made by students to improve and develop the course.
- Giving the opportunity for students to express their opinions about what is taught and receive proposals and study their effectiveness.