



**Superior University**

**Artificial Intelligence**

Module Handbook

3

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## 1 Course Delivery Arrangements

<b>Course</b>	Artificial Intelligence (AI) .
<b>Credit Hours</b>	3.
<b>Lecture Duration</b>	3 Hours per week.
<b>Semester Duration</b>	15 weeks.

## 2 Course Instructors

Module Leader	
<b>Name</b>	Khurram Jilani
Module Tutors	
<b>Name</b>	Amna Khan
<b>Contact Information</b>	<a href="mailto:amna.khan@superior.edu.pk">amna.khan@superior.edu.pk</a>
<b>Room and Building</b>	Department of CS & IT
<b>Consultation Hours:</b>	Monday Tuesday:1:30 pm 4:00pm Wednesday:08:00 am 03:30 pm Thursday Friday: 10:00 am 1:30 pm

### 2.1 Course Introduction

Technologies are shifting gears very fast and due to advancement in internet, computational sciences and Nano technologies we demands smart application and appliances because of our imaginative horizons.

Smart application and smart programs are not smart enough yet, to design and develop themselves. Humans as smarter species are striving to engineer smarter products. We humans require being educated in all aspects of technologies in order to produce intelligent applications and machines to facilitate human race.

To achieve this desire we need to be wise enough to skill ourselves to train machines to learn and evolve so that they can truly be smart and intelligent applications and machines by being skilled in problem solving utilizing concepts of AI.

<b>Program:</b>	BS-CS, MCS		
<b>Semester:</b>	6,4	<b>Session:</b>	2015-16
<b>Pre Requisites:</b>	Fundamental of Algorithms, Data Structures		
<b>Reference Materials:</b>	Text Book 1: <b>Artificial Intelligence: A Modern Approach 3<sup>rd</sup> edition.</b> Authors: Stuart Russell and Peter Norvig. ISBN-13: 978-0136042594  Text Book 2: <b>Artificial Intelligence: Structures and Strategies for Complex Problem Solving 6<sup>th</sup> edition.</b> Authors: George F luger.		

	ISBN-13: 978-0-321-54589-3
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### 3 Course Objectives

This course is designed to develop the following capabilities in the students to understand;

#### Theoretical and conceptual skills development:

- How A.I. is different from tradition computing system.
- The association between various discipline of computer science and artificial intelligence.
- That artificial intelligence is at the core of modern and advanced computing systems.
- Various schools of thoughts on artificial intelligence including weak artificial intelligence, strong artificial intelligence, neat and scurfy artificial intelligence.
- Formulation of working hypothesis for weak and strong artificial intelligence. Also, their limitations and delimitations.
- Domestic industrial, scientific scaled data analysis and robotic applications.
- Different artificial intelligence approaches to machine intelligence.
- Different environments and various architectures of intelligent agents.
- Different machine learning techniques i.e. supervised and unsupervised learning.
- How human brain works, what is neuron structure and back-propagation neural network to simulate supervised learning.
- Natural language processing and its use in modern robotic era.

#### 3.1 Practical skill development:

- Student will be motivated and encouraged to choose a practical project which should be in parameters of AI.
- Projects can be of any nature inclusive of expert systems, robotics, games and smart systems, providing students with a broader spectrum to learn new tools and technologies according to their field of interest.
- Projects are intended to enable students to be skilled in various domains as all the projects will be shared and discussed quarterly.
- The discussion of individual projects will be a great asset as the class will be working as a group and help each other by sharing the problem areas and there solutions.

### 4 Course Coverage

#### 4.1 Primary Course outline:

- Motivation
- Introduction to Artificial Intelligence
- Applications and Success stories on artificial intelligence
- Good Old Fashion AI(GOFAI) and problem solving
- Approaches to machine intelligence.
- Intelligent Agents
- Machine Learning
- Neural Networks
- Problem Solving By Searching
- Genetic Algorithms
- Belief Networks
- Computer vision
- Knowledge Representation
- Natural Language processing and Computer Vision
- Machine Consciousness and Artificial Life
- Robotics and intelligent systems
- Implementation of AI in different domains

**4.2 Auxiliary course content:**

Students will be provided with basic knowledge of following:

- Sensors and its type
- How sensors can be implemented in various applications
- Microcontrollers boards i.e. Arduino and their programming
- How to incorporate various modules such as GSM, Bluetooth and WiFi with Microcontroller boards and sensors.

Student semester projects will enable them to incorporate their existing skills with new tools and technologies to explore new ideas.

**5 Students Gain**

Classification	Teaching and learning methodology	Assessment
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<b>5.1.1 Knowledge and Comprehension</b>		
The course is designed to increase students' understanding on basic and advanced concepts of Artificial Intelligence, Machine Learning and their modular structure, the services provided and how they work.	Students gain knowledge and understanding through lectures and self-directed study. Class activities will be used to enhance their understanding of the concepts. Comprehension will be improved through various written and oral tests.	Students' knowledge and understanding will be assessed through: quizzes, tests, mid-term paper final term viva and exam paper.
<b>5.2 Application and Skills</b>		
At the end of this module, successful students will be able to demonstrate the knowledge of: Initial Level Implementation of; Neural Network and Genetic Algorithm on C# using Aforge Library.	Written exercises and resource based learning will help students in strengthening their research skills and applying those skills to achieve various academic endeavors.	Students' practical skills will be assessed by: viva; quizzes and final term paper.
<b>5.3 Analysis and Synthesis</b>		
Critical analysis of latest Artificial General Intelligence and Machine Learning techniques and their services will help students understanding current research themes.	Students will learn summarizing and synthesizing skills through participating in lectures discussions. Analytical skills will be learnt through self-study, classroom activities and viva.	Students skills are measured through tests, viva and classroom activities.

## 6 Competitive Analysis

Sr#	University Name	National/ International	Course coverage	Value Additions
1	HEC	National	100%	
2	COMSATS	National	85%	<ul style="list-style-type: none"> <li>▪ Inference in PL and reasoning Patterns in PL</li> <li>▪ Fibonacci numbers</li> <li>▪ Permutations and combinations</li> </ul>
3	LUMS	National	90%	<ul style="list-style-type: none"> <li>▪ Uncertainty and inference</li> <li>▪ Concept learning</li> </ul>
4	NUST	National	90%	<ul style="list-style-type: none"> <li>▪ The Structure of agents</li> <li>▪ Constraints Satisfaction problems</li> </ul>
5	KTH	International (Sweden)	80%	<ul style="list-style-type: none"> <li>▪ Heuristics and games</li> <li>▪ Decision and utility theory</li> </ul>
6	MIT	International (USA)	90%	<ul style="list-style-type: none"> <li>▪ Learning in intelligent-system engineering</li> <li>▪ Vision and language in understanding human intelligence</li> </ul>
7	Sussex University	International (UK)	80%	<ul style="list-style-type: none"> <li>▪ computer software, hardware and foundations</li> <li>▪ Development of intelligent computer systems</li> <li>▪ Study of intelligence in both people and machines</li> </ul>
8	Superior University	National	100%	<ul style="list-style-type: none"> <li>▪ Machine Consciousness and Artificial Life</li> <li>▪ Computer visions</li> <li>▪ Intelligent system design for industry</li> <li>▪ Automated smart vehicle design</li> </ul>

## 7 Certification Relevance

Sr#	Certification	Institute	% Relevance
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1	Nil	Nil		
2				

### 8 Industrial Capabilities

- Students can have a firm base to understand concepts of weak and strong AI.
- Students will be able to demonstrate understanding of industrial and commercial expert systems.
- Student will be able to demonstrate Computational implementations and prototyping.
- Students will be able to understand base of robotics and intelligent systems.
- Students will be able to understand and present their understanding of AI for industrial automated plants and expert systems.

Certified By: \_\_\_\_\_

Organization: \_\_\_\_\_

Designation: \_\_\_\_\_

### 9 Skill Portfolio

Sr#	Skills Name	How to Achieve
<b>9.1 Technical Skills</b>		
1	Microcontroller board programming	Demonstrations. Assignments. Projects.
2	Hardware components of automated systems	Demonstrations. Assignments. Projects.
3	Computational implementations and prototyping	Lectures Sketch boarding Simulators
4	Virtual reality and augmented reality	Lectures Demonstrations
5	Base of Internet of things (IOT), SCADA and Robotics.	Lectures Class tasks Projects
<b>9.2 Soft Skills</b>		

1	Planning	Individual or in group students have to follow strict time lines from very first lecture i.e. planning for the group, planning for completion of class assignment and projects.
2	Time management	Assignments, class activities projects and presentations have tight time lines so to meet the time lines students will have to be very precise about time management.
3	Presentation skills	Every assignment and project will have to be presented inform of audience of 40 to 60 individuals, students will be well guided about lingual and gestures of presentations inclusive of dress codes and presentation ethics.
4	Communication Skills	Every lecture will include discussion sessions of at least 8 to 10 minutes where students will be encouraged to speak up about their curiosities and ideas to enhance their communication skills use of English language will be encouraged.
5	Team building	Assignments and projects will be accepted in groups each group will contain students with different grades, students will be encouraged to work out of their comfort zone and learn and demonstrate team building skills
6	People skill	At least one assignment will contain requirement analysis task plus student will have to deal with various individuals while performing their industry related tasks that will enhance their people skills.

## **10 Teaching and Learning Strategy:**

This course will be taught by the combination of theoretical and programming lectures. Theoretical Lectures will be used to provide in depth and conceptual framework for each goal. Lectures with programming, simulation and audio/video demonstration will be used to provide the practice and applied knowledge and understanding of the concepts learned through theoretical content.

Assignments and quizzes will be used as assessment tool to ensure and monitor students learning progress. Assignments will be based on theoretical, programming and application designing concepts in order to ensure that student has grasped the issues in the development of intelligent systems.

The main strategy is to educate students to explore their field of interest and incorporate the content of AI to engineer a product in form of a smart application, expert system, game or an automated intelligent system.

### **10.1 Lectures**

- 1 Lecture sessions are designed to interactively present conceptual content of AI in an elaborative manner inclusive of real time examples.
- 2 Students are encouraged to build concepts rather memorizing sentences.
- 3 Content of the lecture is accessible for all students inclusive of content slides, video demonstrations and case study documents.
- 4 Discussion is part of lectures where students and teacher will have an opportunity to explore new examples and that may produce unique ideas.
- 5 Students will be asked questions related to prior lectures and sessions to keep them focused in the class so they do not take discussions for granted.
- 6 Students would be highly encouraged to ask any and as many question related to the subject matter during and after lectures.

### **10.2 Assignments**

All the assignments from pre-mid to final project included in the course are on individual basis. Students are expected to do the work on their own and produce quality material. However they are free to consult other students, teacher, books and online resources to

build up an understanding of the problem given to them. Mainly the assignments are divided in three phases as mentioned below.

**10.2.1 Writing and Style Considerations**

Given the importance of a carefully selected Artificial Intelligence Module, the following writing and style guidelines generally apply.

- Use a direct professional writing style, present and future tenses with active voice generally better than past tense and passive voice.
- Be positive and specific.
- Use numbers for impact, justifying computations and projections with facts or reasonable quantitative assumptions where possible.
- Use visuals where appropriate. Screenshots, Illustrations graphs and charts enable large amount of information to be presented concisely.
- Shoot for a document of 10 to 20 pages in length not including references and any available appendices.

**11 Assessments**

**11.1 Exam Papers**

Mid and final term exams will be conducted in order to evaluate the students learning and their understanding of the concepts. Exam paper will help in assessing the knowledge, comprehension, analytical and synthesis skills of students (sample papers are attached in annexure b). The detail of the content coverage in each term paper is discussed below:

Content coverage	
<b>Mid Term Paper</b>	
	<b>Weightage</b>
Objective	15 Marks
Subjective	25 Marks
<b>Total</b>	<b>40 marks</b>
<b>Final-Term Paper</b>	
	<b>Weightage</b>
Objective	25 Marks
Subjective	75 Marks
<b>Total</b>	<b>100 marks</b>

11.2 Assignment

Content coverage	
Mid-Term/Final Term Assignment	
	Weightage
Document	30%
Presentation	20%
Class Activity	10%
Viva	40%

11.3 Sample Assignment

	<b>Artificial Intelligence</b> <b>Assignment # 1</b> Contact: <a href="mailto:Khurram.jilani@superior.edu.pk">Khurram.jilani@superior.edu.pk</a>	<b>Total Marks: 10</b>  <b>Due Date: XX-XX-XXXX</b>
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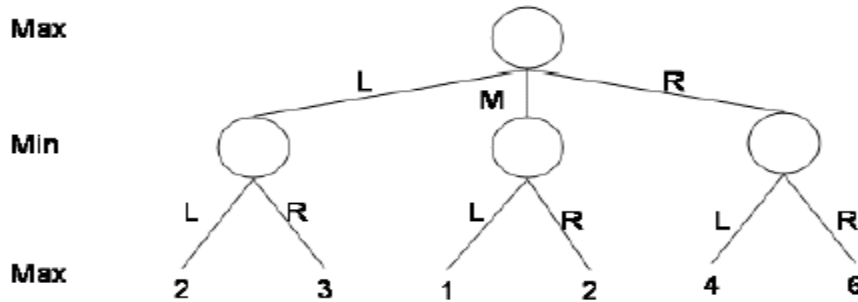
**Instructions:** It should be clear that your assignment will not get any credit (zero marks) if:

- The assignment is submitted after due date.
- The submitted assignment does not open or file corrupt.
- The assignment is copied (from other student or copy from handouts or internet).
- Student ID is not mentioned in the assignment File or name of file is other than student ID.

**Assignment**

**Question:**

Consider the game tree shown below. The top node is a max node. The labels on the arcs are the moves. The numbers in the bottom layer are the values of the different outcomes of the game to the max player.



What is the value of the game to the max player? 2. What first move should the max player make? 3. Assuming the max player makes that move, what is the best next move for the min player, assuming that this is the entire game tree? 4. Using alpha-beta pruning, consider the nodes from right to left, which nodes are cut off? Circle the nodes that are not examined.

**Solution:**

1. What is the value of the game to the max player?

Answer: 4

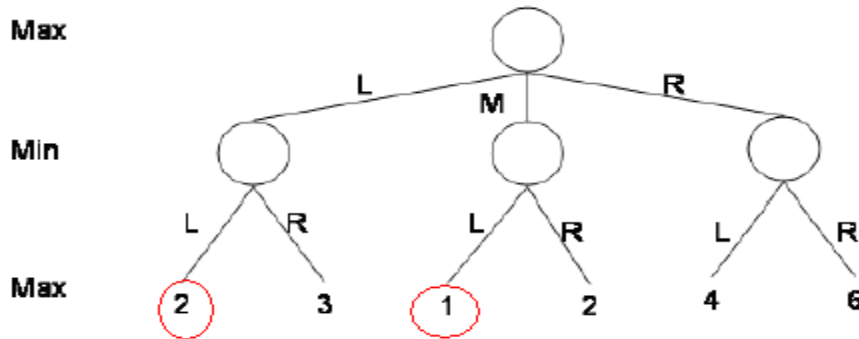
2. What first move should the max player make?

Answer: **R**

3. Assuming the max player makes that move, what is the best next move for the min player, assuming that this is the entire game tree? Answer: **L**

4. Using alpha-beta pruning, consider the nodes from **right to left**, which nodes are cut off? Circle the nodes that are not examined.

Answer: **The nodes that are not examined are the left-most node labeled "2" and the node labeled "1."**



Note: Try to be precise and original in your solution, assignment shall be submitted in DOC file (Word File).

**Deadline:** Your assignment must be submitted on or before: XX-XXXX-XX

### 11.4 Sample Exam Paper

12 Lecture plan

Session	Topics	Session Objective	Student Gain	Lecture Break up																						
<b>Course Goals and Objective</b>																										
<b>Week 1</b>	<ul style="list-style-type: none"> <li>Motivation</li> <li>Explain how A.I. is different from tradition computing system</li> <li>Motivate students by explaining the association between various discipline of computer science and artificial intelligence</li> <li>Make students realize that artificial intelligence is at the core of modern and advanced computing systems</li> <li>Ensure them the progress in artificial intelligence indicates more job opportunities.</li> <li>Discuss in detail the central dogma of computer science</li> <li>Discuss in detail the central dogma of artificial intelligence</li> <li>Communicate Alan Turing’s concept related to machine becoming intelligent and role of Turing machines.</li> </ul>	<ul style="list-style-type: none"> <li>To understand how the concept of AI was generated.</li> <li>To understand the association between various discipline of computer science and artificial intelligence.</li> </ul>	<p>Students will be able to understand</p> <ul style="list-style-type: none"> <li>How A.I. is different from tradition computing system.</li> <li>That artificial intelligence is at the core of modern and advanced computing systems.</li> </ul>	<table border="1"> <tr> <td colspan="2"><b>Lecture 1</b></td> </tr> <tr> <td>Ice breaking session</td> <td>10 min</td> </tr> <tr> <td>Module discussion</td> <td>10 min</td> </tr> <tr> <td>Lecture</td> <td>40 min</td> </tr> <tr> <td>Question/Answers</td> <td>10 min</td> </tr> <tr> <td>Attendance</td> <td>5 min</td> </tr> <tr> <td colspan="2"><b>Lecture 2</b></td> </tr> <tr> <td>Review of previous session</td> <td>15 min</td> </tr> <tr> <td>Lecture</td> <td>45 min</td> </tr> <tr> <td>Question/Answers</td> <td>10 min</td> </tr> <tr> <td>Attendance</td> <td>5 min</td> </tr> </table>	<b>Lecture 1</b>		Ice breaking session	10 min	Module discussion	10 min	Lecture	40 min	Question/Answers	10 min	Attendance	5 min	<b>Lecture 2</b>		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min
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Lecture	45 min																									
Question/Answers	10 min																									
Attendance	5 min																									
<b>Class Activity:</b> demonstrate what Turing machine is and how it use to work.																										
<b>Introduction to Artificial Intelligence</b>																										
<b>Week 2</b>	<ul style="list-style-type: none"> <li>Discuss various definitions on intelligence and artificial intelligence</li> <li>Discuss various schools of thoughts on artificial intelligence including weak artificial intelligence, strong artificial intelligence, neat artificial intelligence, scurfy artificial intelligence.</li> <li>Formulate working hypothesis for weak and strong artificial intelligence. Also, explain their limitations and delimitations.</li> </ul>	To understand various schools of thoughts on artificial intelligence including weak artificial intelligence, strong artificial intelligence, neat artificial intelligence, scurfy artificial intelligence.	<p>Students will be able to understand</p> <ul style="list-style-type: none"> <li>Formulation of working hypothesis for weak and strong artificial intelligence. Also, their limitations and delimitations.</li> </ul>	<table border="1"> <tr> <td colspan="2"><b>Lecture 3</b></td> </tr> <tr> <td>Review of previous session</td> <td>15 min</td> </tr> <tr> <td>Lecture</td> <td>45 min</td> </tr> <tr> <td>Question/Answers</td> <td>10 min</td> </tr> <tr> <td>Attendance</td> <td>5 min</td> </tr> <tr> <td colspan="2"><b>Lecture 4</b></td> </tr> <tr> <td>Review of previous session</td> <td>15 min</td> </tr> <tr> <td>Lecture</td> <td>45 min</td> </tr> <tr> <td>Question/Answers</td> <td>10 min</td> </tr> <tr> <td>Attendance</td> <td>5 min</td> </tr> </table>	<b>Lecture 3</b>		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min	<b>Lecture 4</b>		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min		
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Review of previous session	15 min																									
Lecture	45 min																									
Question/Answers	10 min																									
Attendance	5 min																									
<b>Class Activity:</b> Demonstrate current successful prototypes such as, self-calibrating robotics cheetah and horse Also provides visual examples of successful AI products.																										

## Lesson Plan Guideline

Applications and Success stories on artificial intelligence			
<b>Week 3</b>	<ul style="list-style-type: none"> <li>Discuss foundation of AI.</li> <li>Explain differences of strong AI and Weak AI and explain applications and commercial products depicting Strong and Weak AI.</li> <li>Explain classification of AI and provide students with real world example .i.e. pattern recognition, soft sensing, anomaly detection, control engineering and signal processing.</li> <li>Discuss and explain domains of AI such as: Robotics, Expert systems , Human and animal behavior modeling</li> <li>Discuss possible application which students can produce related to smart products robotics and expert systems</li> </ul>	<p>To understand the technological advantages and role of artificial intelligence concepts in producing various application and commercial products related to applied and strong artificial intelligence</p>	<p>Students will be able to understand</p> <ul style="list-style-type: none"> <li>Students shall understand how AI is implanted in real world and what the core products and prospects success stories are.</li> <li>That how they can chose to produce a application to develop according to their field of interest and expertise in certain domain.</li> </ul>
<b>Class Activity:</b> project discussion, allow students to present their ideas and try to guide them according to realistic approach.		Midterm Assignment Discussion	
Approaches to machine intelligence			
<b>Week 4</b>	<ul style="list-style-type: none"> <li>Discuss various methods to make machines intelligence including GOFAI, Cybernetics, Sub-symbolic AI, Evolutionary Computing, Intelligent Agents, Quantum Artificial Intelligence and Artificial Life including wet, hard and soft life</li> <li>Discuss the difference between cybernetics and artificial intelligence based on the philosophy of the knowledge.</li> </ul>	<p>To understand various methods to make machines intelligence including GOFAI, Cybernetics, Sub-symbolic AI, Evolutionary Computing, Intelligent Agents.</p>	<p>Students will be able to understand</p> <ul style="list-style-type: none"> <li>Different artificial intelligence approaches to machine intelligence.</li> </ul>
<b>Case Study:</b> Smart homes.		Midterm Assignment Discussion (cont.)	

<b>Lecture 5</b>	
Review of previous session	15 min
Lecture	45 min
Question/Answers	10 min
Attendance	5 min
<b>Lecture 6</b>	
Review of previous session	15 min
Lecture	45 min
Question/Answers	10 min
Attendance	5 min

<b>Lecture 7</b>	
Review of previous session	15 min
Lecture	45 min
Question/Answers	10 min
Attendance	5 min
<b>Lecture 8</b>	
Review of previous session	15 min
Lecture	45 min
Question/Answers	10 min
Attendance	5 min



## Lesson Plan Guideline

Intelligent Agents																								
<b>Week 5</b>	<ul style="list-style-type: none"> <li>Explain the distributed artificial intelligence.</li> <li>Explain what rational and intelligent agents are.</li> <li>Discuss how rational agents are conceptualized based on PEAS</li> <li>Provide examples of PEAS for expert systems, robotics and etc.</li> <li>Discuss various environment of intelligent agents</li> <li>Discuss how taxonomy of intelligent agents.</li> <li>Discuss various architectures of designing agents against taxonomies.</li> <li>Explain sensors in context to PEAS.</li> <li>Discuss sensors according to the nature of projects which student's intent to develop i.e. Robotics, smart applications etc.</li> </ul>	<p>To understand the distributed artificial intelligence and intelligent agents.</p> <p>To understand why PEAS has significance in context to any domain of AI.</p> <p>To understand various sensors to have a practical approach in regards to robotics and smart application.</p>	<p>Students will be able to understand</p> <ul style="list-style-type: none"> <li>Different environments and various architectures of intelligent agents.</li> </ul>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr style="background-color: #e0e0e0;"><th colspan="2" style="text-align: left; padding: 2px;">Lecture 9</th></tr> <tr><td style="padding: 2px;">Review of previous session</td><td style="text-align: center; padding: 2px;">15 min</td></tr> <tr><td style="padding: 2px;">Lecture</td><td style="text-align: center; padding: 2px;">45 min</td></tr> <tr><td style="padding: 2px;">Question/Answers</td><td style="text-align: center; padding: 2px;">10 min</td></tr> <tr><td style="padding: 2px;">Attendance</td><td style="text-align: center; padding: 2px;">5 min</td></tr> <tr style="background-color: #e0e0e0;"><th colspan="2" style="text-align: left; padding: 2px;">Lecture 10</th></tr> <tr><td style="padding: 2px;">Review of previous session</td><td style="text-align: center; padding: 2px;">15 min</td></tr> <tr><td style="padding: 2px;">Lecture</td><td style="text-align: center; padding: 2px;">45 min</td></tr> <tr><td style="padding: 2px;">Question/Answers</td><td style="text-align: center; padding: 2px;">10 min</td></tr> <tr><td style="padding: 2px;">Attendance</td><td style="text-align: center; padding: 2px;">5 min</td></tr> </table>	Lecture 9		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min	Lecture 10		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min
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<b>Class activity:</b> Sensors and how sensors can be incorporated in various products to train them intelligently.																								
Midterm Assignment Discussion (cont.)																								
Machine Learning																								
<b>Week 6</b>	<ul style="list-style-type: none"> <li>Explain what learning and knowledge acquisition process is.</li> <li>Discuss how learning is associated with hypothesis searching. .</li> <li>Discuss classification, clustering, forecasting, function approximation, associations as application domains with reference supervised, unsupervised and reinforcement learning.</li> <li>Discuss how these applications are implemented in different industries and computer science domains like data mining, bioinformatics and computational sciences.</li> <li>Discuss various methods to implement machine learning</li> <li>Discuss various data preparation and encoding techniques for machine learning</li> </ul>	<p>To understand classification, clustering, forecasting, function approximation, associations as application domains with reference supervised, unsupervised and reinforcement learning.</p>	<p>Students will be able to understand</p> <ul style="list-style-type: none"> <li>Different machine learning techniques i.e. supervised and unsupervised learning.</li> </ul>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr style="background-color: #e0e0e0;"><th colspan="2" style="text-align: left; padding: 2px;">Lecture 11</th></tr> <tr><td style="padding: 2px;">Review of previous session</td><td style="text-align: center; padding: 2px;">15 min</td></tr> <tr><td style="padding: 2px;">Lecture</td><td style="text-align: center; padding: 2px;">45 min</td></tr> <tr><td style="padding: 2px;">Question/Answers</td><td style="text-align: center; padding: 2px;">10 min</td></tr> <tr><td style="padding: 2px;">Attendance</td><td style="text-align: center; padding: 2px;">5 min</td></tr> <tr style="background-color: #e0e0e0;"><th colspan="2" style="text-align: left; padding: 2px;">Lecture 12</th></tr> <tr><td style="padding: 2px;">Review of previous session</td><td style="text-align: center; padding: 2px;">15 min</td></tr> <tr><td style="padding: 2px;">Lecture</td><td style="text-align: center; padding: 2px;">45 min</td></tr> <tr><td style="padding: 2px;">Question/Answers</td><td style="text-align: center; padding: 2px;">10 min</td></tr> <tr><td style="padding: 2px;">Attendance</td><td style="text-align: center; padding: 2px;">5 min</td></tr> </table>	Lecture 11		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min	Lecture 12		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min
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<b>Class Activity:</b> Demonstration clip of ASIMO in context of supervised, unsupervised and reinforcement learning.																								
Midterm Assignment (cont.)																								

## Lesson Plan Guideline

Neural Networks																								
<b>Week 7</b>	<ul style="list-style-type: none"> <li>Explain how human brain works and what the structure of a neuron is.</li> <li>Derive an artificial neuron using linear algebra and vector analysis based on the working of a biological neuron.</li> <li>Discuss threshold logic unit and numerically simulate basic artificial neuron that was implemented in Perceptron Mark I (1943)</li> <li>Explain how neural network is structures. Discuss their topologies and configurations</li> <li>Construct a back-propagation neural network to simulate supervised learning</li> <li>Construct Self organizing maps to simulates unsupervised learning using neural networks</li> <li>Simulate linear and non-learning digital logic gates using neural networks for demonstration purpose.</li> </ul>	<p>To understand an artificial neuron using linear algebra and vector analysis based on the working of a biological neuron.</p>	<p>Students will be able to understand</p> <ul style="list-style-type: none"> <li>How human brain works, what is neuron structure and back-propagation neural network to simulate supervised learning.</li> </ul>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr style="background-color: #cccccc;"><td colspan="2" style="text-align: left;"><b>Lecture 13</b></td></tr> <tr><td>Review of previous session</td><td style="text-align: center;">15 min</td></tr> <tr><td>Lecture</td><td style="text-align: center;">45 min</td></tr> <tr><td>Question/Answers</td><td style="text-align: center;">10 min</td></tr> <tr><td>Attendance</td><td style="text-align: center;">5 min</td></tr> <tr style="background-color: #cccccc;"><td colspan="2" style="text-align: left;"><b>Lecture 14</b></td></tr> <tr><td>Review of previous session</td><td style="text-align: center;">15 min</td></tr> <tr><td>Lecture</td><td style="text-align: center;">45 min</td></tr> <tr><td>Question/Answers</td><td style="text-align: center;">10 min</td></tr> <tr><td>Attendance</td><td style="text-align: center;">5 min</td></tr> </table>	<b>Lecture 13</b>		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min	<b>Lecture 14</b>		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min
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<b>Class Activity:</b> Introduction Aforge and infer libraries for neural network programming.																								
Midterm Assignment (cont.)																								
<b>Week 8</b>	<b>Mid-Term Exam</b>																							
<b>Problem Solving By Searching</b>																								
<b>Week 9</b>	<ul style="list-style-type: none"> <li>Problem solving agents.</li> <li>Uniformed search strategies like depth first search and breadth first search.</li> <li>Informal search and exploration like greedy best-first search, A* search, hill-climbing search.</li> <li>Constraint satisfaction problems.</li> <li>Adversarial search.</li> </ul>	<p>To understand Informal search and exploration like greedy best-first search, A* search, hill-climbing search.</p>	<p>Students will be able to understand</p> <ul style="list-style-type: none"> <li>Different searching algorithm for problem solving agents.</li> </ul>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr style="background-color: #cccccc;"><td colspan="2" style="text-align: left;"><b>Lecture 17</b></td></tr> <tr><td>Review of previous session</td><td style="text-align: center;">15 min</td></tr> <tr><td>Lecture</td><td style="text-align: center;">45 min</td></tr> <tr><td>Question/Answers</td><td style="text-align: center;">10 min</td></tr> <tr><td>Attendance</td><td style="text-align: center;">5 min</td></tr> <tr style="background-color: #cccccc;"><td colspan="2" style="text-align: left;"><b>Lecture 18</b></td></tr> <tr><td>Review of previous session</td><td style="text-align: center;">15 min</td></tr> <tr><td>Lecture</td><td style="text-align: center;">45 min</td></tr> <tr><td>Question/Answers</td><td style="text-align: center;">10 min</td></tr> <tr><td>Attendance</td><td style="text-align: center;">5 min</td></tr> </table>	<b>Lecture 17</b>		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min	<b>Lecture 18</b>		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min
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Final Project Discussion																								

## Lesson Plan Guideline

Genetic Algorithms																								
<b>Week 10</b>	<ul style="list-style-type: none"> <li>Explain how genetic evolution and Darwin theory works.</li> <li>Map biological concepts to computing concepts using data structures development approach.</li> <li>Explain the working of genetic algorithm using function approximation example.</li> <li>Explain how genetic algorithms can automatically evolve and optimize a neural network structure.</li> </ul>	To understand genetic evolution and genetic algorithms.	Students will be able to understand <ul style="list-style-type: none"> <li>How genetic algorithms can automatically evolve and optimize a neural network structure.</li> <li>Genetic evolution and Darwin theory to develop genetic algorithm.</li> </ul>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr style="background-color: #e0e0e0;"><th colspan="2" style="text-align: left; padding: 2px;">Lecture 19</th></tr> <tr><td style="padding: 2px;">Review of previous session</td><td style="padding: 2px; text-align: center;">15 min</td></tr> <tr><td style="padding: 2px;">Lecture</td><td style="padding: 2px; text-align: center;">45 min</td></tr> <tr><td style="padding: 2px;">Question/Answers</td><td style="padding: 2px; text-align: center;">10 min</td></tr> <tr><td style="padding: 2px;">Attendance</td><td style="padding: 2px; text-align: center;">5 min</td></tr> <tr style="background-color: #e0e0e0;"><th colspan="2" style="text-align: left; padding: 2px;">Lecture 20</th></tr> <tr><td style="padding: 2px;">Review of previous session</td><td style="padding: 2px; text-align: center;">15 min</td></tr> <tr><td style="padding: 2px;">Lecture</td><td style="padding: 2px; text-align: center;">45 min</td></tr> <tr><td style="padding: 2px;">Question/Answers</td><td style="padding: 2px; text-align: center;">10 min</td></tr> <tr><td style="padding: 2px;">Attendance</td><td style="padding: 2px; text-align: center;">5 min</td></tr> </table>	Lecture 19		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min	Lecture 20		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min
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<b>Class Activity:</b>																								
Final Project Discussion																								
Belief Networks																								
<b>Week 11</b>	<ul style="list-style-type: none"> <li>Formulate the example where uncertainty is high and traditional computing fails to evaluate the situation.</li> <li>Discuss Bayesian theorem</li> <li>Use Bayesian theorem to formulate Bayesian networks.</li> <li>Explain with the help of weather forecasting or medical diagnostic examples, how Bayesian networks can be used to simulate believes in machines</li> </ul>	To understand Bayesian Algorithm with examples.	Students will be able to understand <ul style="list-style-type: none"> <li>Bayesian networks and their use to simulate believe in machines.</li> </ul>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr style="background-color: #e0e0e0;"><th colspan="2" style="text-align: left; padding: 2px;">Lecture 21</th></tr> <tr><td style="padding: 2px;">Review of previous session</td><td style="padding: 2px; text-align: center;">15 min</td></tr> <tr><td style="padding: 2px;">Lecture</td><td style="padding: 2px; text-align: center;">45 min</td></tr> <tr><td style="padding: 2px;">Question/Answers</td><td style="padding: 2px; text-align: center;">10 min</td></tr> <tr><td style="padding: 2px;">Attendance</td><td style="padding: 2px; text-align: center;">5 min</td></tr> <tr style="background-color: #e0e0e0;"><th colspan="2" style="text-align: left; padding: 2px;">Lecture 22</th></tr> <tr><td style="padding: 2px;">Review of previous session</td><td style="padding: 2px; text-align: center;">15 min</td></tr> <tr><td style="padding: 2px;">Lecture</td><td style="padding: 2px; text-align: center;">45 min</td></tr> <tr><td style="padding: 2px;">Question/Answers</td><td style="padding: 2px; text-align: center;">10 min</td></tr> <tr><td style="padding: 2px;">Attendance</td><td style="padding: 2px; text-align: center;">5 min</td></tr> </table>	Lecture 21		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min	Lecture 22		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min
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Final Project Discussion																								

## Lesson Plan Guideline

Planning																									
<b>Week 12</b>	<ul style="list-style-type: none"> <li>Discuss Planning</li> <li>How to do planning and acting in real world</li> <li>Uncertainty</li> <li>Probabilistic reasoning</li> <li>Probabilistic reasoning over time</li> </ul>	To understand probabilistic reasoning and planning.	Students will be able to understand <ul style="list-style-type: none"> <li>Planning and probabilistic reasoning.</li> </ul>		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr style="background-color: #e0e0e0;"><td colspan="2"><b>Lecture 23</b></td></tr> <tr><td>Review of previous session</td><td style="text-align: right;">15 min</td></tr> <tr><td>Lecture</td><td style="text-align: right;">45 min</td></tr> <tr><td>Question/Answers</td><td style="text-align: right;">10 min</td></tr> <tr><td>Attendance</td><td style="text-align: right;">5 min</td></tr> <tr style="background-color: #e0e0e0;"><td colspan="2"><b>Lecture 24</b></td></tr> <tr><td>Review of previous session</td><td style="text-align: right;">15 min</td></tr> <tr><td>Lecture</td><td style="text-align: right;">45 min</td></tr> <tr><td>Question/Answers</td><td style="text-align: right;">10 min</td></tr> <tr><td>Attendance</td><td style="text-align: right;">5 min</td></tr> </table>	<b>Lecture 23</b>		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min	<b>Lecture 24</b>		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min
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Knowledge Representation																									
<b>Week 13</b>	<ul style="list-style-type: none"> <li>Discuss the importance of knowledge representation techniques</li> <li>Discuss various classical method for knowledge representation including semantic nets, scripts and frames</li> <li>Introduce modern approaches including KQML and OWL</li> </ul>	To understand various classical method for knowledge representation including semantic nets, scripts and frames.	Students will be able to understand <ul style="list-style-type: none"> <li>Classical and modern methods for knowledge representation including semantic nets, scripts and frames.</li> </ul>		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr style="background-color: #e0e0e0;"><td colspan="2"><b>Lecture 25</b></td></tr> <tr><td>Review of previous session</td><td style="text-align: right;">15 min</td></tr> <tr><td>Lecture</td><td style="text-align: right;">45 min</td></tr> <tr><td>Question/Answers</td><td style="text-align: right;">10 min</td></tr> <tr><td>Attendance</td><td style="text-align: right;">5 min</td></tr> <tr style="background-color: #e0e0e0;"><td colspan="2"><b>Lecture 26</b></td></tr> <tr><td>Review of previous session</td><td style="text-align: right;">15 min</td></tr> <tr><td>Lecture</td><td style="text-align: right;">45 min</td></tr> <tr><td>Question/Answers</td><td style="text-align: right;">10 min</td></tr> <tr><td>Attendance</td><td style="text-align: right;">5 min</td></tr> </table>	<b>Lecture 25</b>		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min	<b>Lecture 26</b>		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min
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Final Project Discussion																									

## Lesson Plan Guideline

<b>Natural Language processing and Computer Vision</b>																								
<b>Week 14</b>	<ul style="list-style-type: none"> <li>Provide an overview of natural language processing.</li> <li>Discuss based steps to implement natural processing system</li> <li>Discuss Alice and Eliza as case study to explain NLP at introductory level</li> <li>Introduce Sharp-NLP, Concept Net Util and MS Speech engine for NLP</li> <li>Provide an overview of computer vision</li> <li>Discuss basic steps computer vision.</li> <li>Discuss basic methods for face detection using open CV</li> </ul>	To understand natural language processing with examples.	Students will be able to understand <ul style="list-style-type: none"> <li>Natural language processing and its use in modern robotic era.</li> <li>Methods for face detection using open CV</li> </ul>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr style="background-color: #cccccc;"> <th colspan="2" style="text-align: left; padding: 2px;"><b>Lecture 27</b></th> </tr> <tr> <td style="padding: 2px;">Review of previous session</td> <td style="padding: 2px; text-align: center;">15 min</td> </tr> <tr> <td style="padding: 2px;">Lecture</td> <td style="padding: 2px; text-align: center;">45 min</td> </tr> <tr> <td style="padding: 2px;">Question/Answers</td> <td style="padding: 2px; text-align: center;">10 min</td> </tr> <tr> <td style="padding: 2px;">Attendance</td> <td style="padding: 2px; text-align: center;">5 min</td> </tr> <tr style="background-color: #cccccc;"> <th colspan="2" style="text-align: left; padding: 2px;"><b>Lecture 28</b></th> </tr> <tr> <td style="padding: 2px;">Review of previous session</td> <td style="padding: 2px; text-align: center;">15 min</td> </tr> <tr> <td style="padding: 2px;">Lecture</td> <td style="padding: 2px; text-align: center;">45 min</td> </tr> <tr> <td style="padding: 2px;">Question/Answers</td> <td style="padding: 2px; text-align: center;">10 min</td> </tr> <tr> <td style="padding: 2px;">Attendance</td> <td style="padding: 2px; text-align: center;">5 min</td> </tr> </table>	<b>Lecture 27</b>		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min	<b>Lecture 28</b>		Review of previous session	15 min	Lecture	45 min	Question/Answers	10 min	Attendance	5 min
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<b>Case Study:</b>																								
Final Project Discussion																								
<b>Machine Consciousness and Artificial Life &amp; Revision</b>																								
<b>Week 15</b>	<ul style="list-style-type: none"> <li>Provide an introduction to machine consciousness and artificial life through seminar</li> <li>Discussion will be conducted on final term viva and final term paper</li> <li>Revision of course</li> </ul>																							
<b>Final-Term Exam</b>																								

### 13 Grading of course

Sr.#	Contents	Weightage
<b>Pre-Mid Assessment</b>		
1	Assignment	10%
2	Mid Term Exam	20%
<b>Post-Mid Assessment</b>		
3	Final Project	30%
4	Final Term Exam	30%
5	Assignment	10%
<b>Overall Percentage</b>		100%

### 14 Academic & Disciplinary Policies

#### 14.1 Late Submission:

According to the University policy, an assignment submitted after the due date, without an approved extension, will be penalized at the rate of 20% deduction of the possible maximum marks of the assessment item. This policy is applicable till the next working day after due date and time of assignment. Assignments submitted after this will be awarded zero marks.

#### 14.2 Absenteeism:

Late coming and shortage in attendance i.e. 3 continual absents from class, ensure that students will be struck off from the relevant subject. It is not acceptable for you to disturb the class by entering late. If you are unavoidably late, then please wait outside until the lecturer indicates you may come in.

#### 14.3 Scholastic Honesty:

Superior University expects each student to do his/her own work. The University has "zero tolerance" for cheating, plagiarism, unauthorized collaboration on quizzes and papers, using "notes" during exams, submitting someone else's work as one's own, submitting work previously submitted for another course, or facilitating acts of academic dishonesty by others. The penalties are severe!

#### **14.4 Plagiarism**

University policy prohibits students plagiarizing, collusion, copying and ghost writing any material under any circumstances. A student plagiarizes if he or she presents the thoughts or works of another as one's own. This definition may include:

- Using another's ideas without due acknowledgement;
- Working with others without permission and presenting the resulting work as though it was completed independently.
- Aiding another student to plagiarize is also a violation of the plagiarism Policy and may invoke a penalty.

#### **15 Class Rules and Regulations**

- All mobile phones must remain switched off (not kept on silent / vibration mode) for the entire duration of a class. Any breach of this rule will lead to immediate confiscation of the phone, which will only be returned after the semester is over.
- No food, drinks, bubble gum or beetle-nut will be allowed inside the classroom.
- In order to maintain the sanctity and decorum on the University Campus, all male and female students are required to be dressed in a decent and appropriate manner. Please note carefully that under no circumstances you will be allowed to attend classes in a casual and shabby getup, for example, dirty and un-ironed clothes. The University shall take a particularly stern view of any kind of immodest and revealing clothes, such as shalwar-qameez with long slits, shirts with low necklines, skirts and tight or torn jeans. Male students may wear shalwar-qameez with waist-coat and sandals with straps.

- Cheating, plagiarism, offensive language and disruptive behavior will be addressed according to policies for academic misconduct mentioned in the Students' Handbook.
- A student must have maximum participation in class lecture and activities. He/she should think critically to make effective arguments during the class.
- Give respect to your class mates in terms of their opinions and arguments. A student is encouraged to make opposing argument but maintain class decorum cannot be ignored.
- A 15-minute break will be given. Any student coming late or returning late after the break will be considered absent for that day.
- In case of cancellation / makeup of a class you shall be notified through the program manager or class coordinator.
- If you fail to attend at least 90% of the sessions you will receive an F grade for the module

## 16 Assignments description

Assignments Description
<p><b>Objective:</b></p> <p>The objective of these short assignments is to give students the opportunity to practice skills they have learned in class and to demonstrate and extend their understanding of AI Paradigm and its subdivision.</p> <p><b>Guidelines:</b></p> <ul style="list-style-type: none"><li>• Assignment one will be an individual assignment that is to be submitted in form of soft copy by email to course instructor.</li><li>• Assignment two will be a group assignment that is to be submitted in form of soft copy by email to course instructor.</li><li>• Individual can discuss the design concepts with your class fellows, but the actual work should be your own.</li><li>• The assignments will be evaluated on the basis displays.</li><li>• One before midterm and after midterm will be conducted.</li></ul> <p><b><u>Assignment 1:</u></b></p>



Due in week 4

**Assignment 2:**

Due in week 8

Evaluation Criteria and Rubrics	
<b>Learning Outcomes</b>	<ol style="list-style-type: none"> <li>1. Understanding of cognition.</li> <li>2. Understanding of HCI and HMI in context to commercial and industrial applications.</li> <li>3. Understanding of HCI/HMI in context to IOT, SCADA and robotics</li> <li>4. Understanding of UI and UX designing</li> <li>5. Demonstration of working prototype of an HCI application.</li> </ol>
Grading Descriptors	
<ol style="list-style-type: none"> <li>1. <b>Understanding Concepts.</b> <ul style="list-style-type: none"> <li>• <b>Attempt/Implementation</b></li> <li>• <b>Code Hierarchy</b></li> </ul> </li>   <li>2. <b>Understanding the usability aspect of Classes and Objects</b> <ul style="list-style-type: none"> <li>• <b>Definition of class and its members</b></li> <li>• <b>Testing using objects</b></li> </ul> </li> </ol>	<p><b>Grading Range(1-5)</b>  <b>Satisfactory:</b> Definition is missing but Domain analysis is complete then it would be considered satisfactory  <b>Excellent:</b> performance will be considered Excellent if and only if all the sub-tasks are complete and of quality.  <b>Poor:</b> It would be graded as POOR if none of the sub-task is included in the project.</p> <p><b>Grading Range(1-5)</b>  A user friendly and fortified system design deserves the max 5 and vice versa.  <b>Satisfactory:</b> if Class Definition is not implemented in the assignment but Domain analysis is complete then it would be considered satisfactory  <b>Excellent:</b> performance will be considered Excellent if and only if all the sub-tasks are complete and of quality.  <b>Poor:</b> It would be graded as POOR if none of the sub-task is included in the project.</p>

<p><b>3. Conventions</b></p> <ul style="list-style-type: none"> <li>• Naming</li> <li>• Indentation</li> <li>• Declaration</li> <li>• Comments</li> </ul> <p><b>4. Development of Professional coding techniques</b></p>	<p><b>Grading Range(1-5)</b> A user friendly and fortified system design deserves the max 5 and vice versa.</p> <p><b>Satisfactory:</b> if IDE is not implemented in the project but Domain analysis is complete then it would be considered satisfactory <b>Excellent:</b> performance will be considered Excellent if and only if all the sub-tasks are complete and of quality. <b>Poor:</b> It would be graded as POOR if none of the sub-task is included in the project.</p> <p><b>Grading Range(1-5)</b> A Complete efficient submission deserves the max 5 and vice versa. <b>Satisfactory:</b> if delivering of the contents is not enough then it would be considered satisfactory <b>Excellent:</b> performance will be considered Excellent if and only if all the sub-tasks are complete and of quality with complete defense of the contents and development. <b>Poor:</b> It would be graded as POOR if the participant could not be able to deliver it properly.</p>
<p><b>Assignment Submission Guide Lines</b></p>	<p><b>When to Submit:</b> Tentative (According to the session)</p> <p><b>How to submit:</b> The process of assignment submission is including use of cover page, submission in hard and soft form. <b>Soft-Copy:</b> The assignment is to submit with the student information in the class in soft form. <b>Extension:</b> In-case of extension submission the student has to follow any particular method of submission instructed by the resource person. Late Approval will be signed by the Program Manager Office.</p>

<b>Special Instruction / Other information if any</b>	<p><b>Following URL's can be consulted for further study:</b></p> <p><a href="http://www.ergonomics.org.uk/resources/links/ergonomics.htm">http://www.ergonomics.org.uk/resources/links/ergonomics.htm</a>  <a href="http://www.britishdesign.co.uk/">http://www.britishdesign.co.uk/</a>  <a href="http://www.primalpictures.com/Index.aspx">http://www.primalpictures.com/Index.aspx</a>  <a href="http://www.iea.cc/">http://www.iea.cc/</a>  <a href="http://www.ergonomics4schools.com/lzone/aesthetics.htm">http://www.ergonomics4schools.com/lzone/aesthetics.htm</a>  <a href="http://www.iep.utm.edu/a/aestheti.htm">http://www.iep.utm.edu/a/aestheti.htm</a></p>
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## 17 Semester Project

<b>17.1 Project Description</b>	<p>Projects will require students to implement a hybrid of software and hardware by combining either mobile application development and IOT components or robotics.</p> <p>If a group is interested in developing a pure software based project they will be motivated to develop a project related to augmented or virtual reality.</p>
<b>17.2 Learning Out Comes</b>	<ol style="list-style-type: none"> <li>1. Student will be able to convert the theory of the subject into practical demonstration</li> <li>2. The project will include working prototypes plus presentation and viva of the project.</li> <li>3. The project will not add technical skills but it will also enhance presentation and communication skills of the students.</li> </ol>
<b>17.3 Time Duration</b>	<p>Before Mid-term Exam to the end of Semester (Almost 8 Weeks)</p>

<b>17.4 Size of team</b>	<p>4-Mebers Team</p> <ul style="list-style-type: none"> <li>• Team description is as follows: Member 1 having CGPA above3</li> <li>• Member 2 having CGPA above 2.5</li> <li>• Member 3 having CGPA above 2.0</li> <li>• Member 4 having CGPA below 2.0</li> </ul>

## 18 Assessment GPA and Percentages

**(80-100%)** This is an outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic ability; mastery of skills (as identified in the assessment task); and achievement of all assessment objectives.

**(70-79%)** This is an excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills (as identified in the assessment task); and achievement of all assessment objectives.

**(60-69%)** This is a very good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic ability; reasonable development of skills (as identified in the assessment task); and achievement of all assessment objectives.

**(50-59%)** This is a satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic ability; satisfactory development of skills (as identified in the assessment task); and achievement of most assessment objectives.

**Fail (less than 50%)** This is an unsatisfactory standard indicating an inadequate knowledge and understanding of the relevant materials; insufficient evidence of academic ability; failure to develop skills (as identified in the assessment task); and failure to achieve assessment objectives.

## 19 Appendix

### 19.1.1 Appendix A (Course Outlines)

**Course Name:** Artificial Intelligence

**Credit Hours:** 3

**Prerequisites:** Introduction to Software Engineering Course Outlines:

**Revised by:** HEC (2013)

**Outline:**

- AI Paradigms and Hypothesis
- Intelligent Agents.
- Difference between Cybernetic Intelligence and Artificial Intelligence,
- Objectives and Scope of Weak AI and Strong AI,
- Problem-solving
- Informed Search and Exploration
- Constraint Satisfaction Problems
- Adversarial Search.
- Knowledge Representation and reasoning, Uncertain knowledge and reasoning.
- Logical Agents
- Planning and Acting in the Real World.
- Learning, learning methods and knowledge from learning.
- Communicating, perceiving, and acting:
- Probabilistic Language Processing,
- Perception and Robotics.
- Introduction to LISP/PROLOG and Expert Systems (ES) and Applications
- Artificial General Intelligence
- Issues in Safe AI
- Introduction to Cognitive and Conscious Systems.

**Course Name:** Artificial Intelligence (CSE 860)

**Credit Hours:** 3

**Prerequisites:** Introduction to Software Engineering

**Institution:** NUST (Pakistan)

**Outline:**

- Introduction to AI
- Intelligent agents
- The Structure of agents
- Problem solving by searches
- Search Strategies
- Uninformed Searches
- Informed searches
- Genetic algorithms
- Constraints Satisfaction problems
- Adversarial Searches
- Logical agents
- Machine Learning
- Natural language Understanding

**Course Name:** Artificial Intelligence (CSC456)

**Credit Hours:** 3

**Prerequisites:** Introduction to Software Engineering

**Institution:** COMSATS (Pakistan)

**Outline:**

- The Human, Computers and the Interaction
- Fundamentals of AI
- Its history and definitions
- Problem solving methodologies
- General purpose search algorithm
- Uniformed and informed searches.
- Knowledge based agents
- Propositional logic (PL)
- Inference in PL and reasoning Patterns in PL
- Counting arguments
- Sum and product rule,
- Inclusion exclusion principle
- Arithmetic and geometric progressions
- Fibonacci numbers
- The pigeonhole principle
- Permutations and combinations



**Course Name:** Artificial Intelligence (CS331)

**Credit Hours:** 3

**Prerequisites:** Introduction to Software Engineering

**Institution:** LUMS (Pakistan)

**Outline:**

- Introduction and intelligent agents
- Blind search
- Heuristic search
- Adversarial search
- Constraint satisfaction problem
- Logic and inference
- Uncertainty and inference
- Concept learning
- Intro to natural language processing
- AI languages and systems

**Course Name:** Artificial Intelligence (6.034)

**Credit Hours:** 3

**Prerequisites:** Applied computer sciences and fundamental of programming

**Institution:** MIT (USA)

**Outline:**

- Foundation and fundamentals of AI.
- Basic knowledge representation
- Problem solving
- Learning methods of artificial intelligence
- Learning in intelligent-system engineering
- Vision and language in understanding human intelligence
- Computational perspective
- Applied systems and intelligent systems
- Rule chaining
- Heuristic search
- Constraint propagation and constrained search,
- Inheritance and identification trees
- Neural nets and genetic algorithms
- Human intelligence
- Knowledge representation
- Artificial Intelligence and Robotics

**Course Name:** Artificial Intelligence (DD2380)

**Credit Hours:** 3

**Prerequisites:** Applied computer sciences and fundamental of programming

**Institution:** KTH (Sweden)

**Outline:**

- Theoretical aspects of AI.
- Problem solving with search algorithms
- Heuristics and games
- Knowledge representation (logic)
- Representing uncertain knowledge and reasoning (Bayesian networks, HMM)
- Decision and utility theory
- Communication and models for probabilistic language processing.

**Course Name:** Artificial Intelligence (H7064)

**Credit Hours:** 3

**Prerequisites:** Engineering Design

**Institution:** Sussex University (United Kingdom)

**Outline:**

- Foundation of AI.
- computer software, hardware and foundations
- Intelligent computer systems
- Study of intelligence in both people and machines
- Fundamental principles of computer science and artificial intelligence
- Logical concepts, data structures, algorithms and design approaches
- Software based solutions
- Development of intelligent computer systems
- Search
- Knowledge based expert systems
- Strong and weak AI

19.1.2 Appendix C (Practice Problems)



**Artificial Intelligence**  
**Assignment # 1**  
 Contact: [Khurram.jilani@superior.edu.pk](mailto:Khurram.jilani@superior.edu.pk)

**Total Marks: 10**  
**Due Date: XX-XX-XXXX**

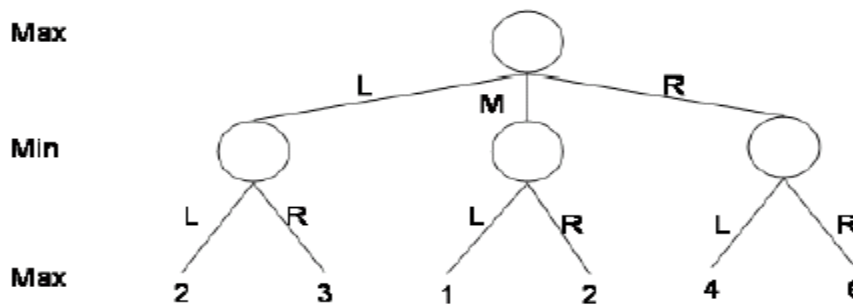
**Instructions:** It should be clear that your assignment will not get any credit (zero marks) if:

- The assignment is submitted after due date.
- The submitted assignment does not open or file corrupt.
- The assignment is copied (from other student or copy from handouts or internet).
- Student ID is not mentioned in the assignment File or name of file is other than student ID.

**Assignment**

**Question:**

Consider the game tree shown below. The top node is a max node. The labels on the arcs are the moves. The numbers in the bottom layer are the values of the different outcomes of the game to the max player.



What is the value of the game to the max player? 2. What first move should the max player make? 3. Assuming the max player makes that move, what is the best next move for the min player, assuming that this is the entire game tree? 4. Using alpha-beta pruning, consider the nodes from right to left, which nodes are cut off? Circle the nodes that are not examined.

**Solution:**

1. What is the value of the game to the max player?

Answer: 4

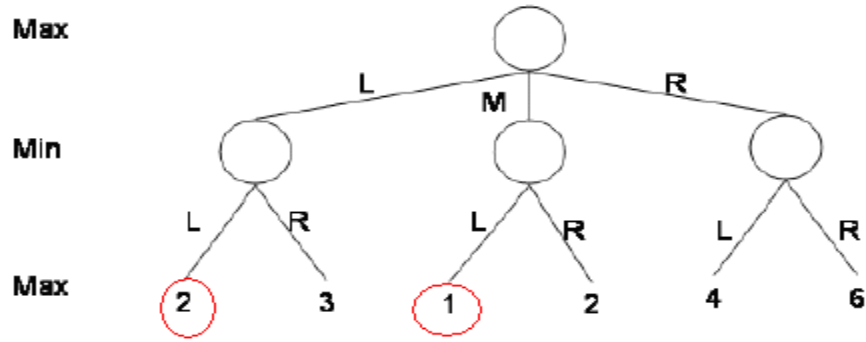
2. What first move should the max player make?

Answer: R

3. Assuming the max player makes that move, what is the best next move for the min player, assuming that this is the entire game tree? Answer: L

4. Using alpha-beta pruning, consider the nodes from right to left, which nodes are cut off? Circle the nodes that are not examined.

Answer: The nodes that are not examined are the left-most node labeled "2" and the node labeled "1."



Note: Try to be precise and original in your solution, assignment shall be submitted in DOC file (Word File).

**Deadline:** Your assignment must be submitted on or before: xx-xxxx-xx