Ministry of Higher Education and
Scientific Research - Iraq
University of Technology-Iraq
Department of Computer Science
Networks Management Branch

# MODULE DESCRIPTOR FORM
# نموذج وصف المادة الدراسية

| Module Information | | |
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| معلومات المادة الدراسية | | |
| **Module Title** | INTELLIGENT SEARCH TECHNIQUES | **Module Delivery** |
| **Module Type** | CORE | **Theory** **Lecture** **Lab** **Tutorial** |
| **Module Code** | INST225 | |
| **ECTS Credits** | 5 | |
| **SWL (hr/sem)** | 125 | |

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| **Module Level** | 2 | **Semester of Delivery** | 4 |
| **Administering Department** | Department of Computer Science | **College** | Computer Science |
| **Module Leader** | Rasha M. Mohsin | **e-mail** | Rasha.m.mohsin@uotechnology.edu.iq |
| **Module Leader's Acad. Title** | Asst. Lect | **Module Leader's Qualification** | M.Sc. |
| **Module Tutor** | Rasha M. Mohsin | **e-mail** | Rasha.m.mohsin@uotechnology.edu.iq |
| **Peer Reviewer Name** | | **e-mail** | |
| **Review Committee Approval** | 01/06/2024 | **Version Number** | 1.0 |

| Relation With Other Modules | | | |
|---|---|---|---|
| العلاقة مع المواد الدراسية الأخرى | | | |
| **Prerequisite module** | | **Semester** | 2 |
| **Co-requisites module** | | **Semester** | |
| **Module Aims, Learning Outcomes and Indicative Contents** | | | |
| أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية | | | |

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| **Module Aims**<br>أهداف المادة الدراسية | The module aims to:<br><br>1. Problem Formulation:<br>   • Understand how to precisely formulate a search problem so that it can be effectively solved using search algorithms.<br><br>   • Discuss the characteristics of the environment and the available information critical for choosing the right search method.<br><br>2. Uninformed Search Methods:<br>   • Explore search techniques that require minimal knowledge about the problem being solved.<br><br>3. Informed Search Techniques:<br>   • Study methods that provide optimal solutions but require background knowledge about the solution.<br><br>4. Evaluation and Definitions:<br>   • Define search techniques consistently and discuss how to evaluate search algorithms. |
| **Module Learning Outcomes**<br>مخرجات التعلم للمادة الدراسية | The learning outcomes:<br><br>1. Understanding Search Algorithms:<br><br>   • Describe the fundamental principles of search algorithms used in artificial intelligence.<br>   • Explain various uninformed<br><br>2. Implementing Search Techniques:<br><br>   • Implement basic and advanced search algorithms in a programming language.<br>   • Evaluate the performance of different search algorithms in terms of time complexity, space complexity, and optimality.<br><br>3. Optimization and Heuristics:<br><br>   • Design heuristic functions for informed search techniques to improve search efficiency.<br>   • Apply optimization techniques such as local search and population-based search.<br><br>4. Problem-Solving Skills:<br><br>   • Formulate real-world problems as search problems.<br>   • Develop solutions for complex problems using appropriate search techniques.<br><br>5. Critical Analysis: |

|  | <ul><li>Compare and contrast various search techniques in terms of their strengths and weaknesses.</li><li>Critically analyze case studies and research papers on intelligent search methods.</li></ul><br>6. Application of Search Techniques:<br><ul><li>Apply intelligent search techniques to specific domains such as robotics, game playing, scheduling, and planning.</li><li>Demonstrate the use of search algorithms in practical applications through projects or assignments.</li></ul> |
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| **Indicative Contents**<br>المحتويات الإرشادية | ❖ What means by A.I.<br>❖ Principles &Fundamentals of A.I.<br>❖ Knowledge Representation Methods.<br>    • Logical Representation<br>    • Network Representation<br>❖ Clause Form<br>❖ Resolution Theorem Proving<br>❖ Problem state space, Search space<br>❖ Problem solving approach<br>❖ Search Methods<br>❖ Blind Search<br>    • Depth First Search, Breadth First Search<br>❖ Heuristic Search<br>    • Hill Climbing Search, Best First Search, A-algorithm, A*-algor<br>❖ Using Heuristics in games<br>    • 8-Puzzle Problem<br>    • Tic Tac Toe Problem<br>❖ Control Strategy<br>    • Backward Chaining<br>    • Forward Chaining |

## Learning and Teaching Strategies
### استراتيجيات التعلم والتعليم

| | Teaching and learning strategies for an Intelligent Search Techniques module : |
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| **Strategies** | 1. Lectures<br>    • Conceptual Understanding: Lectures should cover the fundamental concepts, algorithms, and theories behind intelligent search techniques.<br>    • Use of Visual Aids: Incorporate slides, diagrams, and flowcharts to explain complex algorithms and processes.<br>2. Hands-On Labs and Practical Sessions<br>    • Programming Exercises<br>    • Simulation Tools<br>    • Experimentation<br>3. Project-Based Learning<br>4. Seminars and Workshops<br>5. Assessment and Feedback: Conduct quizzes, mid-term exams, and peer assessments to evaluate students' understanding continuously.<br>6. Reading: Assigned Readings, Provide a list of textbooks |

## Student Workload (SWL)
الحمل الدراسي للطالب

| Structured SWL (h/sem)<br>الحمل الدراسي المنتظم للطالب خلال الفصل | 78 | Structured SWL (h/w)<br>الحمل الدراسي المنتظم للطالب أسبوعيا | 5.2 |
|---|---|---|---|
| Unstructured SWL (h/sem)<br>الحمل الدراسي غير المنتظم للطالب خلال الفصل | 47 | Unstructured SWL (h/w)<br>الحمل الدراسي غير المنتظم للطالب أسبوعيا | 3.1 |
| Total SWL (h/sem)<br>الحمل الدراسي الكلي للطالب خلال الفصل | 125 | | |

## Module Evaluation
تقييم المادة الدراسية

| | | Time/Number | Weight (Marks) | Week Due | Relevant Learning Outcome |
|---|---|---|---|---|---|
| **Formative assessment** | Quizzes | 2 | 10% (10) | Continuous | LO #5 |
| | Assignments | 2 | 10% (10) | Continuous | LO # 3 and 5 |
| | Projects / Lab. | 2 | 10%(10) | Continuous | LO # 2, 3 and 5 |
| | Report | 1 | 10%(10) | 12 | LO # 2, 3 and 5 |
| **Summative assessment** | Midterm Exam | 2hr | 10% (10) | 7 | LO # 1-6 |
| | Final Exam | 2hr | 50% (50) | 16 | LO # 1-6 |
| **Total assessment** | | | 100% (100 Marks) | | |

## Delivery Plan (Weekly Syllabus)
المنهاج الاسبوعي النظري

| | Material Covered |
|---|---|
| Week 1 | What means by AI ?<br>AI principles and fundamentals |
| Week 2 | Knowledge representation methods- Logical representation |

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| **Week 3** | Knowledge representation -Network representation |
| **Week 4** | Problem state space and search space |
| **Week 5** | Intelligent search techniques and problem solving approach |
| **Week 6** | Search Techniques Types ,Blind search (Depth First Search Algorithm) |
| **Week 7** | Blind search (Breadth First Search Algorithm) |
| **Week 8** | Heuristic search (Hill Climbing Algorithm) |
| **Week 9** | Heuristic search (Best First Search Algorithm) |
| **Week 10** | Heuristic search (A Search Algorithm) |
| **Week 11** | Heuristic search (A* Search Algorithm) |
| **Week 12** | Using Heuristics in Games (8-puzzle game) |
| **Week 13** | Using Heuristics in Games (Tic-Tac-Toe game) |
| **Week 14** | Control strategy / backward chaining |
| **Week 15** | Control strategy / forward chaining |

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| **Delivery Plan (Weekly Lab. Syllabus)** <br> المنهاج الاسبوعي للمختبر | |
| | **Material Covered** |
| **Week 1** | Python principles and fund |
| **Week 2** | Python conditions & loops |
| **Week 3** | How to use functions in python |
| **Week 4** | How to design simple intelligent task in python |
| **Week 5** | Tree structure building and representation (cost, without cost, remove, add nodes) |
| **Week 6** | Program of depth first search |
| **Week 7** | Program of breadth first search |
| **Week 8** | Program of hill climbing search |
| **Week 9** | Program of best first search |
| **Week 10** | Program of A-search algorithm |
| **Week 11** | Program of  A*-search algorithm |
| **Week 12** | Program of  Games (8-puzzle game) |
| **Week 13** | Program of backward chaining |
| **Week 14** | Programming of forward chaining |
| **Week 15** | Practical test |

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| **Learning and Teaching Resources** <br> مصادر التعلم والتدريس | | |
| | **Text** | **Available in the** |

| | | Library? |
|---|---|---|
| **Required Texts** | 1. Stefan Edelkamp Stefan Schr odl , *"Heuristic Search Theory and Applications"*, ELSEVIER, 2012. <br> 2. George F. Luger, "*Artificial Intelligence Structures and Strategies for Complex Problem Solving*", Pearson Education Asia (Singapore), Sixth edition 2009**.** <br> 3. M. Tim Jones, *"Artificial Intelligence A Systems Approach"*, Infinity Science Press, 2008. | Yes |
| **Recommended Texts** | | |
| **Websites** | | |

## APPENDIX

| GRADING SCHEME |
| :---: |
| مخطط الدرجات |

| Group | Grade | التقدير | Marks (%) | Definition |
|---|---|---|---|---|
| **Success Group (50 - 100)** | **A -** Excellent | امتياز | 90 - 100 | Outstanding Performance |
| | **B -** Very Good | جيد جدا | 80 - 89 | Above average with some errors |
| | **C -** Good | جيد | 70 - 79 | Sound work with notable errors |
| | **D -** Satisfactory | متوسط | 60 - 69 | Fair but with major shortcomings |
| | **E -** Sufficient | مقبول | 50 - 59 | Work meets minimum criteria |
| **Fail Group (0 – 49)** | **FX –** Fail | مقبول بقرار | (45-49) | More work required but credit awarded |
| | **F –** Fail | راسب | (0-44) | Considerable amount of work required |
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Note:

NB Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.