

***Science and Technology***

*Computer Science*

***Developing Artificial Intelligence***

*CST 3170*

Module Leader: *Chris Huyck*

*Term AY 2022*

Duration of the module 24 weeks

Document Version *1*

**Online location of handbook**

This handbook can also be accessed via My Learning at: [Course: 2022-23 CST3170 Artificial Intelligence (mrooms.net)](https://mdx.mrooms.net/course/view.php?id=32758)

**Other formats available**

This handbook is available in a large print format. If you would like a large print copy or have other requirements for the handbook, please contact the Disability Support Service [disability@mdx.ac.uk](mailto:disability@mdx.ac.uk)

**Disclaimer**

The material in this handbook is as accurate as possible at the date of production. You will be notified of any minor changes promptly. If there are any major changes to the module you will be consulted prior to the changes being confirmed. Please check the version number on the front page of this handbook to ensure that you are using the most accurate information.

**Other documents**

Your module handbook should be read and used alongside your programme handbook and the information available to all students on My Learning and UniHub, including the Academic Regulations. Your programme handbook can be found on the My Learning programme page for your programme.

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# Welcome

This module is an introduction to Artificial Intelligence (AI), focusing on developing AI systems. It is focused around the three pillars of search, machine learning, and knowledge representation, though there is also an attempt to explore some AI subdomains such as vision, robotics and natural language processing.

*Students are expected to attend lectures and labs, do all three course works. Labs will provide experience in programming and in AI techniques, so working on the lab before or after the session is encouraged.*

# The module teaching team

|  |  |  |
| --- | --- | --- |
| Insert Name | | |
| Please insert the staff member photo | Role: | Chris Huyck |
| Room number: | T127 |
| Email: | [c.huyck@mdx.ac.uk](mailto:c.huyck@mdx.ac.uk) |
| Telephone number: | 208-411-5412 |
| Office hours: | To be determined |

# Communication with the teaching team

*Students may contact staff via e-mail, phone, by dropping into staff office hours, and by making an appointment to see them outside office hours.*

*Staff will contact students by e-mail, phone, the My Learning module page and via lectures and seminars.*

*The team may send urgent group or individual messages about the module to you by email, so it is important that you read your University email regularly.*

*All staff have office hours, it is not necessary to book an appointment during these hours, you just need to drop-in.*

*In the first instance problems should be dealt with by talking to a member of the module team. You can give feedback on this module to the module leader, your Student Voice Leader, to your personal tutor, and through the end of module evaluation survey.*

Our most important consideration is your health, wellbeing and safety as well as our staff and people related to the University. Remember that you – as part of #TeamMDX – can stay up-to-date with the guidance on Coronavirus at

<https://unihub.mdx.ac.uk/coronavirus-covid19>

# Module overview

|  |  |
| --- | --- |
| **Module Code** | CST3170 |
| **Module Title** | Artificial Intelligence |
| **Credit** | 30 |
| **Other Restrictions and Requirements** | None |

   
**Aims**   
The aim of the module is to introduce students to a range of AI theories and techniques, including the most commonly used. This will extend to the ability to implement these techniques, and the students will extend their own development skills.

**Learning Outcomes**

**Knowledge**

On completion of this module, the successful student will be able to:

1. Critically analyse common knowledge representation mechanisms.
2. Critically evaluate common machine learning mechanisms

**Skills**

This module will call for the successful student to demonstrate a sophisticated application of information searching:

1. Ability to implement knowledge bases in common knowledge representation formats.
2. Ability to implement machine learning algorithms for particular applications.
3. Ability to use common AI development techniques and languages.

**Syllabus**

* First Order Predicate Logic
* Semantic Nets
* XML
* Statistical techniques including linear approximation.
* Multi-layer perceptrons
* Self-organising maps
* Genetic algorithms
* Rule based systems
* Case base reasoning
* Search mechanisms
* Algorithms for large data sets
* AI areas including language, vision and robotics

**Learning and Teaching Strategy:**

In-depth theoretical overview of machine learning concepts will be delivered in the form of lectures. Students will gain significant hands-on interaction with particular algorithms and representation techniques. Hands-on labs and case studies will help students apply what they learn and to develop critical thinking and complex problem-solving skills.

**Assessment Scheme**

**(a)** **Formative assessment scheme**

The workshops will be used as platforms to discuss various aspects of machine learning and algorithms and representation techniques. Feedback will be given by workshop tutors.

**(b)** **Summative assessment scheme**

The module is assessed by coursework.

100% coursework will be based on hands-on lab exercises. (Learning outcome 1 to 5)

**Assessment Weighting**   
The module is assessed by 100% coursework. - Coursework will be based on hands-on lab exercises.

**Learning Materials**

**Core:**

Russell, S and Norvig, P. (2016) Artificial Intelligence: a Modern Approach, Prentice Hall.  3rd Edition ISBN: 978-1292153964

**Essential:**

Russell, S and Norvig, P. (2016) Artificial Intelligence: a Modern Approach, Prentice Hall.  3rd Edition ISBN: 978-1292153964

**Recommended:**

Brachman, R. and Levesque, H. (2004) Knowledge Representation and Reasoning.  ISBN: 978-1-55860-932-7

Poole, D. and Mackworth, A. (2018) Artificial Intelligence: Foundations of Computational Reasoning. 978-1107195394

**Total Notional Learning Hours**   
300

# 

***Research Ethics –***

**The teaching, learning, assessment and research activities undertaken in this module have been considered and are not likely to require ethical approval**.

* However, please seek advice if undertaking the module entails carrying out any research activities involving **human participants, human data, animals/animal products, precious artefacts, materials or data systems.** If you submit work that includes data gathered from or about people, this may be treated as academic misconduct and could lead to fail grade being awarded.
* Research ethics approval seeks to ensure all research is designed and undertaken according to certain principles of ethical research. These include:

1. Primary concern must be given to the **safety, welfare and dignity** of participants, researchers, colleagues, the environment and the wider community

2. Consideration of **risks** should be undertaken before research commences with the aim of minimising risks to those involved – i.e. human participants or animal subjects, colleagues, the environment and the wider community, as well as actual or potential risks to those directly or indirectly affected by the research.

3. **Informed consent** should be freely given by participants, and by a trained person when collecting or analysing human tissue (details on accessing and completing online training for gaining informed consent for HTA purposes can be found below in Section 8).

4. Respect for the **privacy, confidentiality and anonymity** of participants

5. Consideration of the rights of **people who may be vulnerable** (by virtue of perceived or actual differences in their social status, ethnic origin, gender, mental capacities, or other such characteristics) who may be less competent or able to refuse to give consent to participate

6. Researchers have a responsibility to the general public and to their profession; as such they should balance the anticipated benefits of their research against **potential harm, misuse or abuse** which must be avoided

7. Researchers must demonstrate the highest standards of **ethical conduct and research integrity**. They must work within the limits of their skills, training and experience, and refrain from exploitation, dishonesty, plagiarism, infringement of intellectual property rights and the fabrication of research results. They should declare any actual or potential conflicts of interest, and where necessary take steps to resolve them.

8. When using human tissues for research, Human Tissue Act and Human Tissue Authority (HTA) requirements must be met. Please contact the relevant designated person (DP) in your department or the HTA Designated Individual (DI) (Dr Lucy Ghali - L.Ghali@mdx.ac.uk). Further information is provided below in the section: "Human Tissue Authority Information", see 'Governance Structure" document and SOPs etc.

9. Research should **not involve any illegal activity**, and researchers must comply with all relevant laws.

* For more information about ethics go to the Middlesex Online Research Ethics (MORE) system which has information and guidance to help you meet the highest standards of ethical research using this link: https://MOREform.mdx.ac.uk
* Information and further guidance on how to complete a research ethics application form (e.g., video guides and templates) can be found on the MORE MyLearning site\*: http://mdx.mrooms.net/enrol/index.php?id=12277 (Log in required)

\*Middlesex University Definition of Research document can be located on this site.

# Learning resources

The reading list is available on the link: [CST3170 Artificial Intelligence (Hendon, Dubai, Malta) | Middlesex University (talis.com)](https://rl.talis.com/3/mdx/lists/06215F90-7419-CB9F-8199-DC6C8057EDF9.html?lang=en).

*This module has a variety of learning resources available for you to use to support your learning. These include module notes, worked examples, solutions to exercises, feedback, podcasts, and key reading materials. These can be accessed online via the module page. Please visit the module page regularly to make use of these. These are available on* [*http://www.cwa.mdx.ac.uk/cst3170/cst3170.html*](http://www.cwa.mdx.ac.uk/cst3170/cst3170.html)

# Expectations of studying this module

**Attendance and Engagement**

The module team are here to help and support you achieve your goals. One of the key elements to successfully completing this module is engaging with all of the learning opportunities we offer as well and working with your peers to support one another.

This module is designed as a combination of contact sessions, directed study and independent study. This means you must participate in all the allocated sessions and you must complete all set prework and activities outside them. Students are expected to take an active part in all learning sessions whether these are online or on campus; lectures, lab sessions, practical classes, seminars and workshops.

To make the most of this module please complete the following every week

* Complete all prework in preparation for learning sessions. This may be watching videos, reading through set material or chapters and completing activities. Please make notes of points you need to clarify and discuss these in learning sessions with module tutors.
* Read through the notes making a note of any points you need to discuss with your tutor.
* Complete the set activities before the next session, making a note of any points you need to discuss with your tutor.
* Go to the module My Learning page, attempt the quizzes, make use of extra material, view the podcasts, and access the activity solutions. Make a note of anything you wish to discuss with your tutor.
* Complete further reading from the core text online.

The module team is committed to support you and your fellow students whilst you undertake this module. In order for you to get the most out of sessions you need to come prepared and ready to contribute. Please ensure that any work set by the team has been completed before workshops. After each class please review what has been covered and make a note of anything you would like clarification on.

Engaging with online and on-campus in-person learning and activities is integral to your success.  Middlesex University supports you to achieve your full potential through a number of strategies, all of which provide a supportive learning environment online, remotely, face-to-face, or blended.

Further information on attendance and engaging with your programme will be available at your Induction and updates online at UniHub at the weblink below. <https://unihub.mdx.ac.uk/study/assessment/attendance>

## Professional behaviour and online conduct

The programme of study you are undertaking is underpinned by developing professional behaviour and attitude. It is important that you are respectful and supportive to your fellow students and tutors. Adopting this approach will create a positive atmosphere within sessions and is something you can use in your professional life. You must come to sessions prepared and ready to contribute where appropriate. To access some of the rooms and specialist space used for this module you will need your University ID card. Please remember that your University ID should be carried with you always whilst on campus and you must be able to identify yourself if asked to do so. Please conduct your email communication with fellow students, tutors and all relevant staff in a formal and courteous manner. It is helpful to provide your student number and if you have a query relating to a module include the module number as well.

In the same way that we help you understand how to effectively participate in learning on campus, we also want to make sure that you can make the most of online learning. Our principles of online learning class conduct are available at: <https://unihub.mdx.ac.uk/covid-19-updates-faq/online-classroom-conduct>

## Academic Integrity and Misconduct

You should be aware of the University’s academic integrity and misconduct policies and procedures. Taking unfair advantage over other students in assessment is considered a serious offence by the University. Action will be taken against any student who contravenes the regulations through negligence, foolishness or deliberate intent. Academic misconduct takes several forms, in particular:

* **Plagiarism** – using extensive unacknowledged quotations from, or direct copying of, another person’s work and presenting it for assessment as if it were your own effort. This includes the use of third party essay writing services.
* **Collusion** – working together with other students (without the tutor’s permission), and presenting similar or identical work for assessment.
* **Infringement of Exam Room Rules** – Communication with another candidate, taking notes to your table in the exam room and/or referring to notes during the examination.
* **Self-Plagiarism** – including any material which is identical or substantially similar to material that has already been submitted by you for another assessment in the University or elsewhere.

Students who attempt to gain unfair advantage over others through academic misconduct will be penalised by sanctions, according to the severity of the offence, which can include exclusion from the University. Links to the relevant University regulations and additional support resources can be found here:

**Student Success Essentials** Course which includes Academic Integrity

[**Access to course**](https://mdx.mrooms.net/mod/lesson/view.php?id=877307). -You will have to log into to MyUniHub and then MyLearning to access the course.

Full details on academic integrity and misconduct and the support available can be found at  [Academic Integrity | UniHub (mdx.ac.uk)](https://unihub.mdx.ac.uk/study/academic-integrity)

The Academic Integrity and Misconduct policy is available in our Public Policy Statements (under Academic Quality) at: [Our policies | Middlesex University London (mdx.ac.uk)](https://www.mdx.ac.uk/about-us/policies)

Referencing & Plagiarism: Suspected of plagiarism?:

<http://libguides.mdx.ac.uk/c.php?g=322119&p=2155601>

Referencing and avoiding plagiarism:

<https://unihub.mdx.ac.uk/study/writing-numeracy/awl-resources/writing>

The Middlesex University Students’ Union (MDXSU) Advice Service offers free and independent support in making an appeal, complaint or responding to any allegations of academic or non-academic misconduct.

<https://www.mdxsu.com/advice>

## Extenuating circumstances:

There may be difficult circumstances in your life that affect your ability to meet an assessment deadline or affect your performance in an assessment. These are known as extenuating circumstances or ‘ECs’. Extenuating circumstances are exceptional, seriously adverse and outside of your control. Please see link for further information and guidelines:

<https://unihub.mdx.ac.uk/your-study/assessment-and-regulations/extenuating-circumstances>

# Assessment

Formative assessment**:** Formative assessment is completed during your year of study and provides the opportunity to evaluate your progress with your learning. Formative assessments help show you and us that you are learning and understanding the material covered in this course and allow us to monitor your progress towards achieving the learning outcomes for module. Although formative assessments do not directly contribute to the overall module mark they do provide an important opportunity to receive feedback on your learning.

|  |  |
| --- | --- |
| Formative assessment | Deadline |
| *Weekly Lab Sessions* | *At the end of your weekly session* |

Summative assessment**:** Summative assessment is used to check the level of learning at the end of the course. It is summative because it is based on accumulated learning during the course. The point is to ensure that students have met the learning outcomes for the course and are at the appropriate level. It is the summative assessment that determines the grade that you are awarded for the module.

There three assessment components in this module: the travelling salesman problem, machine learning, and a pandemic chatbot.

All three course works are programs, written in java, by the student. Each is described below, and on the course website. There will be lab sessions devoted for course work support before each submission date. There will be a discussion of each course work in the lecture. You are welcome to ask questions about any course work in any session. Each will be marked out of 100. The final course mark will be based on a weighted sum of the three course work marks. This sum, out of a possible 100 points, will then be converted to the 20 point scale. The student will receive written feedback, within 15 working days, for each course work.

The table below specifies the associated deadlines:

|  |  |  |  |
| --- | --- | --- | --- |
| Summative assessment | Weighting | Deadline | Feedback |
| *Travelling Salesman* | *%25* | *November 18, 2022* | *December 9th* |
| *Machine Learning* | *%35* | *February 16, 2023* | *March 9th* |
| *Chatbot and Agent* | *%40* | *March 30, 2023* | *April 21st* |

## The Travelling Salesman Problem

## Due Date: End of Week 8 (Nov 17 and 18 2022)

## 25% of Overall Course Mark

The coursework is to build a system in Java that solves travelling salesman problems. The travelling salesman problem is to go to each city exactly once and return to the start. Solving the problem should give a path and the length of the path. There are optimal solutions, that is solutions with the shortest path.

Sample files are provided below. They have n lines for n cities. The first integer in the line is the city number (starting with 1 and ending with n) and the second and third integers are the X and Y coordinates of the city. Distance is standard Euclidean distance.

The code should be written entirely by the student. You are entirely welcome to discuss the project with others, but you need to write every single character. If you use an algorithm described elsewhere, please include a reference to that in the report.

The system should be run on the training TSPs, and submitted by 5 pm on 17th. At 5 pm, the test TSPs will be released. The student should run their unmodified system on the tests, gather the results and submit the final project. This should be submitted by 5:00 pm on November 18th to myunihub.

The system should solve the three training sets and the test sets provided on the course web site.,  
Note that you need to make a complete circuit.

**Marking scheme**:

|  |  |
| --- | --- |
| **Points** | **Area** |
| 10 | Self Marking Sheet |
| 10 | Solve First Training Problem |
| 10 | Get Optimal Result for All Three Training Problems. |
| 10 | Describe Algorithm(s) Used |
| 10 | Quality of Code |
| 20 | Get Optimal Results for the First Three Tests |
| 20 | Get Optimal Results for First Three Tests in under a minute. |
| 10 | Best system on Fourth Test (Path length squared times time.) |

The student should provide a self marking sheet with their opinion of their own score. You can not get this wrong if you submit it. Additionally, the student should describe the algorithm or algorithms used. This need not be a long description; typically a paragraph will do, but for simple algorithms less is fine.

The quality of the code will be marked. This includes comments, variable, function and class names, and class structure.

Times: the final 10 points involve time. The student needs to use the system clock to time the algorithm. Use System.nanoTime(); Report times for all solutions and the first solution. The best combination of path length squared multiplied by time on the fourth test will get 10 points. Others may also get points on this criterion.

Submission notes: you should email the system to the tutor on the 10th. The code should not change after 5 on the 17th. The only thing that should change is the reported results of the test problems. It should run from Eclipse. Instructions for running are welcome.

Please submit the code, the mark sheet, and analysis to the coursework 1 folder of CST 3170 on myunihub. You are also welcome to email a copy to the tutor. You must email a copy of the system to the tutor before the test data is released if you want any of the 50 points available for the test data.

## Machine Learning

## Due Date: Week 16 (Thursday, February 16, 2023)

## 35% of Overall Course Mark

This work is to build a machine learning system to categorise one of the UCI digit tasks. You should develop the system on your own from scratch. You should then run a two-fold test, and report your results.

The data is from the University of California at Irvine's Machine Learning Repository. It's the [Optical Recognition of Handwritten Digits Data Set](http://archive.ics.uci.edu/ml/datasets/Optical+Recognition+of_Handwritten+Digits). This gives you two data sets, training set and a test set. I've converted them to two data sets [data set 1](https://www.cwa.mdx.ac.uk/cst3170/coursework/cw2DataSet1.csv), and [data set 2](https://www.cwa.mdx.ac.uk/cst3170/coursework/cw2DataSet2.csv)that should be used by your system.

You should write all of your code. If you use an existing algorithm, you should reference that algorithm in your code and in your report. The code should be written in Java, and should run in the lab from eclipse.

**Marking scheme**:

|  |  |
| --- | --- |
| **Points** | **Area** |
| 20 | Report |
| 20 | Running Code |
| 20 | Quality of Code |
| 20 | Quality of Algorithm |
| 20 | Quality of Results |

You should write a brief (1-2 page) report on your system. This should describe the algorithm you used, and why you chose this algorithm. It should also show the results of a two fold test using the provided data; a brief discussion of data usage would be useful.

Quality of code and algorithm are important for good marks. The code should be well commented and structured. Selection of a good algorithm is also important. Simple algorithms may be effective, but a relatively complex algorithm may get you more points just for effort.

Finally, the quality of the results do matter. To get reasonable marks you need to surpass the baseline reported on the UCI website. This is not a competition between students, but discussing performance with your colleagues will be useful.

Note for scraping by: the base line reported on UCI website is nearest neighbor using Euclidean distance. You should be able to implement this quite easily (and might want to start with this). This should be enough to pass (10 report, 20 running, 10 code, and 5 results).

Please submit the code, the mark sheet, and analysis to the coursework 2 folder of CST 3170 on myunihub. You are also welcome to email a copy to the tutor.

## Pandemic Chatbot and Agents

## Due Date: Week 24 (Thursday, March 30, 2023)

## 40% of Overall Course Mark

Pandemic is a cooperative boardgame. Here is [the Pandemic Wiki](https://en.wikipedia.org/wiki/Pandemic_(board_game)). Two or more players play on a map of the world. The players can move about the board on their turn performing particular actions, like move, remove disease cube, and cure disease. There are two decks of cards, a player deck, and an infection deck. Players collect cards from the player deck, and use these to cure diseases and for other actions. The infection deck is used to add disease cubes to the board. The goal of the game is to solve all four diseases.

Your task is to build a system that allows a user to play the game. A simple version of the system will support many aspects of the game, allow the user to, in essence, play both players. As the game depends on cards, the luck of the draw matters. Depending on the luck of the draw and how the user plays, the user (or the team) should be able to win or lose.

The conversation: the user should interact with the game via a conversation. For the simple version, this can be a series of commands. As the complexity of the system increases, a conversation between the agent and the user can become quite sophisticated. The two can develop a plan via the conversation.

The agent: in the simple version of the system, the user, in essence, plays both players. A more complex version of the system supports a sophisticated agent that can help the user plan. This could use a game tree, remember the cards that have already been played, and use planning.

**Marking scheme**:

|  |  |
| --- | --- |
| **Points** | **Area** |
| 10 | Game Plays |
| 10 | Team can win or lose |
| 10 | Code Style |
| 20 | Report |
| 25 | Conversation |
| 25 | Agent |

## The Game

There are several version of the pandemic game, and we will work with the first version. The system does not have to implement the complete game, but the more that is added the better. Only aspects of the base game should be added. The module leader is happy to explain aspects of the game, and indeed discuss algorithms and data structures that might be used. Moreover, you are welcome to discuss these things with your colleagues, but it is important that all code is user own. Below there is an incomplete description of the game.

There are two or more players that may have extra skills. The players start in Atlanta (where the CDC is) and move about the board. There are 48 cities, 12 of each of the four colours (blue, yellow, red and black). There are two decks of cards: the player deck and the infection deck. At the end of their turn, the player draws cards. When a card from the infection deck is drawn, a cube of that colour is added to the city.

There are two or more players. Typically, the systems will use two players, but an advanced system may have more. Players alternate turns. On their turn a player performs their actions, draws player cards, then draws they may take up to four actions. In simple systems, all players can take up to four actions in their turn, and all are in essence equally powerful. In more advanced systems, there can be different types of players called roles (only one of each type on the team). For example, the Generalist can take five moves, and the Scientist can cure a disease with only four cards. Feel free to implement any of the roles from any of the games. (I like the pilot.)

There are 48 cities 12 of each colour. Colour are associated with diseases, so a blue city like Atlanta is associated with the blue disease. There is a city graph with nearby cities connected to each other. When the user uses the move action, they can only move to a connected city. When there is an outbreak (see below), it only spreads to connected cities.

Disease cubes: at the end of a players turn they draw cards from the infection deck. The disease deck is a deck of 48 cards, one for each city. (Typically players draw two cards, but as you draw epidemic cards you may increase the number players draw.) A disease cube of that colour is placed on the city drawn. Players can take use an action to remove a disease cube from the city they are in. If the disease has been cured, the player can remove all the cubes with one action. To start the game, the players draw nine infection cards. The city from the first three cards gets three infection cubes, the second three get two, and the last three one. These cards are placed in the infection discard pile.

There are 9 types of action a player can take: move, remove disease cube, give card, take card, fly to city, fly from city, fly from research station to research station, cure disease, and build research centre. A player can move to any connected city, and they can remove a disease cube from the city they are in. If the player is in same city as another player, they can give the other player a card or take a card from that player. They can fly to another city if they turn in that city card from their hand, or they can fly to any city by playing the card of the city they are in. If they are in a city with a research station, they can fly to another city that has a research station. A player can cure a disease if they are at a research city and turn in five cards of the same colour for that disease. A player can build a research station in the city they are in by turning in a card for the city they are in.

Again, a disease is cured by a player turning in five player cards of the diseases colour in a research station. A bonus is that if there are no cubes of that colour on the board, the disease is solved. When an infection card of that colour is drawn, no cubes are added.

Player cards are important, but a player can only have 7 cards in their hand at any time. If their turn ends and they have more than 7 cards in their hand, they have to throw enough away to go to 7.

What really makes the game difficult is epidemics. When the game begins, the player deck of 48 cards (one for each city but you can also have magic cards see below) is shuffled and cards are dealt to each player. (For two players each player gets four cards.) The remaining cards are split into four piles. An epidemic card is added to each pile and they are shuffled and the four piles stacked to form the player deck. At the end of each turn, the player draws two new cards. (Playing a magic card or discarding a card to reach their hand limit.) When the player deck is empty, the team loses. If an epidemic card is drawn, the bottom card from the infection deck is selected, and its city is given three cubes. It is then placed in the infection discard pile, which is shuffled and added to the top of the infection deck. When the player then infects, those cards from the top are drawn. If a city with three cubes of the same colour is drawn, there is an outbreak.

Another difficulty that can be included is outbreaks. When there is an outbreak, all of the cities connected to the outbreaking city are given an extra cube. This can lead to a further outbreak, though no city outbreaks twice on a given turn. If there are eight outbreaks in total, the team loses. Note that a city never has more than three cubes of a colour, but it may have cubes of different colours.

When the game starts, there is one research centre, in Atlanta. Players can take an action (turning in a card) to make a new research centre. Diseases can be cured only in a research centre, and players can fly from one research centre to another for an action. There are only 6 research centres.

Magic cards: special cards can be added to the player deck and drawn into players hands. There are a range of them, and you can feel free to put any from the game, or for that matter make up your own into the game. Example cards are fly anywhere, build a research station anywhere, solve a disease with one less cube, and send a card to another player. Once you play a card, it goes into the player discard pile. Adding more magic cards makes it easier form the team to win. Also note that these cards extend the game as they make the deck larger.

The players win the game if the cure all four diseases. They can lose by running out player cards, or by having an eighth outbreak.

## Marking scheme

The marking scheme above goes from simplest to most complex. The game should play. The user (team) should be able to win and lose. Code should be written well, with good comments, good variable names, named constants, and reasonably sized functions.

You should write a brief (1-4 page) report on your system. It should say how to run the program and describe any interesting algorithms or data structures. A simple system will have few game aspects and an agent that just helps the user understand the options of the game. The report can be quite brief and will necessarily get a low (but passing) mark. A more sophisticated system might keep track of the cards and say, when asked, how likely a particular card or type of card is to appear. A more sophisticated system might use a probabilistic game tree, and probabilistic planning to suggest future moves. These aspects could be described in the report to gain a better mark.

The example conversation (from the provided code) is extremely simple and is just a simple one input to one output mapping. A more robust conversation, with sentences and variance, is one way to progress. Feel free to make it fun asking the user's name and creating banter. Part of the robustness of the system is the robustness of the conversation. For reasonable conversation marks, the user should be able to play the game just by chatting. A simple conversational extension might explain the game to the user. That would be more than just a text file dump. However, to get above 20 points, you'll need a proper conversation about what to do in the future. This will probably be supported by an agent that does some degree of planning, or at least can keep track of the decks and talk about them. You can provide a GUI, but command line text interface is fine. What's important is the conversation.

In the simplest game, the user, in essence, plays both players. To give the system a degree of complexity, the user and the agent need to agree on a plan. The agent can then make his actions on his own, though he could get agreement with the user; it is after all a collaborative game. The agent could gain complexity by having a planning system with goals. It could use a probabilistic game tree to help with the planning. Other mechanisms are also plausible. Indeed, an extraordinary coursework might take advantage of the game to learn weightings for decisions so that it could perform better.

Code should be written in Java, should run in the lab from eclipse, and you should write it yourself (except possibly the code I provide below). If you use an existing algorithm, you should reference that algorithm in your code and in your report. The code should be written in Java, and should run in the lab from eclipse. A [city connectivity file is here](https://www.cwa.mdx.ac.uk/cst3170/coursework/fullMap.txt) and my [simple version of pandemic is here](https://www.cwa.mdx.ac.uk/cst3170/coursework/pandemic.java). You are welcome to use this pandemic code, but put describe what you use in the report. It's not enough to pass. You should use the map file or your own variant.

The minimally passing system: it should be easy to get the game playing (10 points). Getting the system to include losing and winning is a bit more complex, and requires the player deck and curing diseases (10 points). Use Standard good coding practice from the beginning (6 points). A reasonable report can be brief on this (8 points). You'll need to get 6 points for the conversation to get 40; this would explain all the moves and the state of the game. (In this case the agent is really just the user playing both players so it get's 0/25).

Please submit the code, and report to the coursework 3 folder of CST 3170 on myunihub. You are also welcome to email a copy to the tutor.

Details of how it will be assessed will be provided in the marking criteria for each assessment and the University overall approach can be found within the Grade Criteria Guide in the University Regulations <https://www.mdx.ac.uk/about-us/policies> (scroll to university regulations)

Reasonable adjustments will be made for those students who have a declared disability/specific learning condition which would affect performance in this area.

Reassessment for this module normally takes place by a resubmission of the failed course works at the next opportunity. Typically, this is in July for Autumn start students.

Further information is available at

https://unihub.mdx.ac.uk/study/assessment

Middlesex University is committed to being fair in its approach to assessing student learning following the [UK Quality Code for Higher Education (Quality Code) (2018](https://www.qaa.ac.uk/quality-code)) and the [UK Quality Code - Advice and Guidance: Assessment (2018)](https://www.qaa.ac.uk/quality-code/advice-and-guidance/assessment) and [External Expertise (2018).](https://www.qaa.ac.uk/quality-code/advice-and-guidance/external-expertise)

The Assessment Fairness guidance, policies and procedures put in place by Middlesex University is our commitment to ensure fairness in assessment and are available at <https://www.mdx.ac.uk/about-us/policies>

If you have any queries or would like to know more on how this approach has been applied to modules you are studying please contact your Programme Leader.

## 7.2 Feedback on your assignments

You will be provided with feedback on all coursework that is helpful and informative, consistent with aiding the learning and development process. The nature of the feedback shall be determined at programme level but may take a variety of forms including: written comments; individual and group tutorial feedback; peer feedback; or other forms of effective and efficient feedback.

Feedback will normally be provided within 15 WORKING DAYS of the published coursework component submission date.

## 7.3 How is your assignment mark agreed?

The following diagram provides an overview of the marking process for your module assessment. Further information on the role of external examiners can be found at. <https://www.mdx.ac.uk/about-us/policies/academic-quality/handbook> (section 4)

## 7.4 Anonymous Marking Assessment Policy

We have worked with the Middlesex University Students’ Union (MDXSU) to create an anonymous marking policy, in response to student feedback.  Anonymous marking ensures that your identity (your name, student number and other personal/identifiable information) is not made available to academics when they are marking your work.  This means that you can have confidence that your assessments will be marked fairly and consistently.  However, there are some forms of assessment for which anonymity cannot be guaranteed and these are recognised in the policy.  We believe that it is important to provide you with the support and guidance needed to help you develop and prepare for your final assessments (those which count towards your final grades i.e. summative assessments).  Therefore, anonymous marking will not apply to learning activities and assessments that do not contribute to your final grades (i.e. formative assessments).  If you require further information and support to understand how anonymous marking works in your programme modules please contact the Module Leader for more information.

The Anonymous Marking Assessment Policy is available at: <https://www.mdx.ac.uk/__data/assets/pdf_file/0037/563599/anonymous-marking-assessment-policy.pdf>

We now look at each component of assessment for this module in detail. Each of the following tables provides an overview of the requirements for each component. The support provided for each component along with the feedback arrangements, is also detailed below. *(amend as appropriate) [It should be made clear within the assessment section how each assessment component is marked whether this be in percentages or marked directly to the 20 point scale. It is recommended that it is made clear how the overall module grade is calculated from the component grades following the latest university guidance. It is also recommended that the University wide 20 point scale is included – see section 9]*

# Learning Planner

*Please distinguish between online and on-campus in person delivery, refer to the*[***Blended Learning Principles***](https://www.intra.mdx.ac.uk/about-us/services/centre-for-academic-practice-enhancement/policy-bank/2022-Principles-of-blended-learning.pdf)*2022-23 for further information]*

*Please include a module schedule with details of what topics are covered when and any information relevant to the session. Give guidance in what students need to complete regularly.*

*This could be done week by week or by block of weeks. We recommend you indicate who will lead the sessions and give details of any work expected of the student before the session. Also highlight assessment and feedback points.*

*Please note that the student activity section should cover all learning activities including online activities and reading along with other work set.*

*You may also wish to link the assessment and feedback to the modules learning outcomes to demonstrate when they have been achieved.*

*This could be done in the form of a table, example below.*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Week beginning** | **Week (s)** | **Lecture**  ((please rename as appropriate) | **Workshop**  (please give detailed description of in-class activities for the day) | **Staff** | **Student Activity** | **Assessment and feedback** |
| Oct 5th | 1 | Discrete probability: counting methods | Calculating probabilities.  Discuss properties of distributions.  Meet the SLAs | AM | Review probability unit 1.  Compete extension activities.  Seek advice from tutors or SLAs. | Select presentation topic and notify module leader |
|  | 2 - 7 | Binomial, Hypergeometric, and Poisson distributions | Identifying suitable probability distributions to model situations.  Use computers to model them. | AM/ NS | Watch screen casts on My Learning page.  Work on assessment task and seek guidance form tutors, and GAAs. | Individual Assessment task 1 released online.  Download and work on activities 1 and 2. |
|  | 8 | Review week | Receive feedback on your progress with assessment tasks. |  |  |  |
|  | 9 - 13 |  |  |  |  |  |
|  | Etc etc |  |  |  |  |  |

# University 20-point Scale

|  |  |  |  |
| --- | --- | --- | --- |
| **20-point scale** | **General scale** | **General scale (full ranges)** | **Percentage used for aggregation purposes only**  (for areas marking directly to the 20 point scale on modules with multiple assessment components) |
| **1** | 80% - 100% | 79.50% - 100% | 90% |
| **2** | 76% - 79% | 75.50% - 79.49% | 77.5% |
| **3** | 73% - 75% | 72.50% - 75.49% | 74% |
| **4** | 70% - 72% | 69.50% - 72.49% | 71% |
| **5** | 67% - 69% | 66.50% - 69.49% | 68% |
| **6** | 65% - 66% | 64.50% - 66.49% | 65.5% |
| **7** | 62% - 64% | 61.50% - 64.49% | 63% |
| **8** | 60% - 61% | 59.50% - 61.49% | 60.5% |
| **9** | 57% - 59% | 56.50% - 59.49% | 58% |
| **10** | 55% - 56% | 54.50% - 56.49% | 55.5% |
| **11** | 52% - 54% | 51.50% - 54.49% | 53% |
| **12** | 50% - 51% | 49.50% - 51.49% | 50.5% |
| **13** | 47% - 49% | 46.50% - 49.49% | 48% |
| **14** | 45% - 46% | 44.50% - 46.49% | 45.5% |
| **15** | 42% - 44% | 41.50% - 44.49% | 43% |
| **16** | 40% - 41% | 39.50% - 41.49% | 40.5% |
| **17** | 35% - 39% | 34.50% - 39.49% | 37% |
| **18** | 30% - 34% | 29.50% - 34.49% | 32% |
| **19** | 0% - 29% | 0.01% - 29.49% | 15% |
| **20** | Non-participation | 0% | 0% (non-submission of a component) |