Scenario 1: ASSESSMENT 3	
Subject Code and Title	MFA501
Assessment	Assessment 3: Solve an AI Problem set
Individual/Group	Individual
Length	Project and supporting document

Task Summary

In this assessment, you are expected to implement an AI algorithm to reconstruct a binary image represented in a 2D array. This assessment is to be completed individually and you are to submit programs and supporting documents via the assessment link in Blackboard. Please refer to the Task Instructions for details on how to complete this assessment.

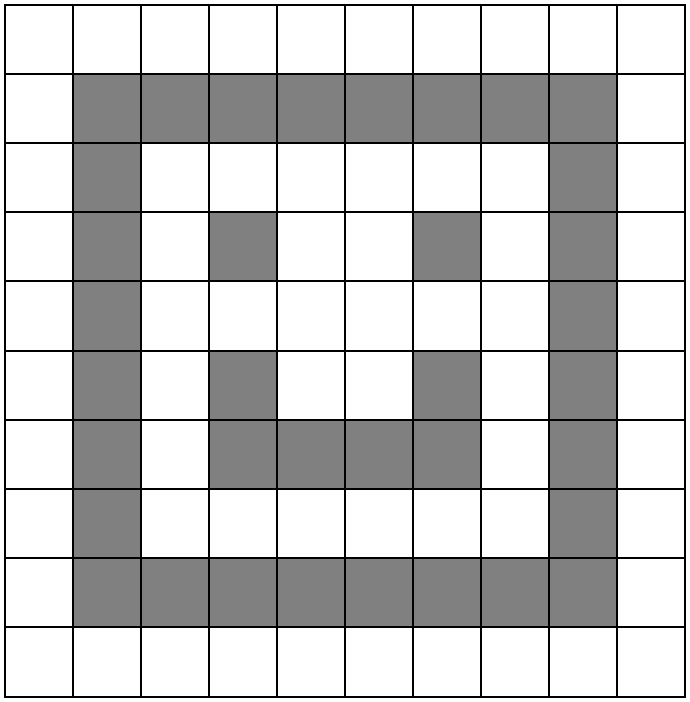
This assessment is intended to determine:

- Your understanding of the theories and mathematical notations covered in Module 1 to 11
- Your ability to formulate and frame a simplified real-world problem for an AI problem solving technique
- Your ability to choose a suitable AI technique for the problem
- Your ability to implement an AI problem solving technique in a modern programming language

We assumed the image is represented in a 2D matrix as follows:

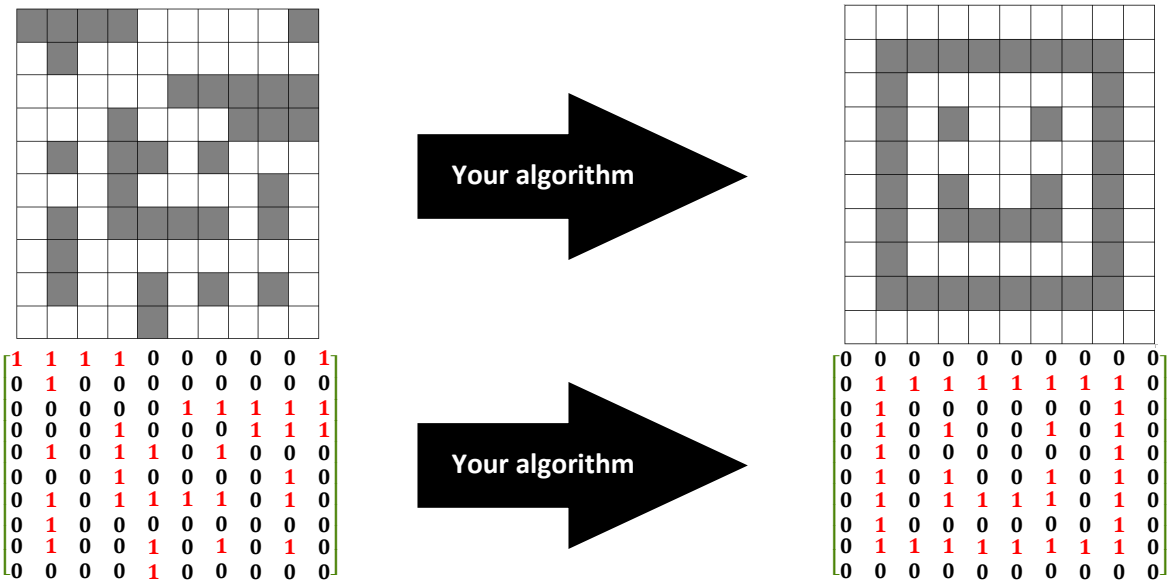
Context

This summative project assesses your skills to use the mathematical models covered in Module 1 to 11 to develop an AI technique and solve a simplified real-world case study. You are required to develop an algorithm to reconstruct a binary image. To represent a binary image, you can use an array. For instance, the following binary image can be reconstructed with a 10x10 matrix:

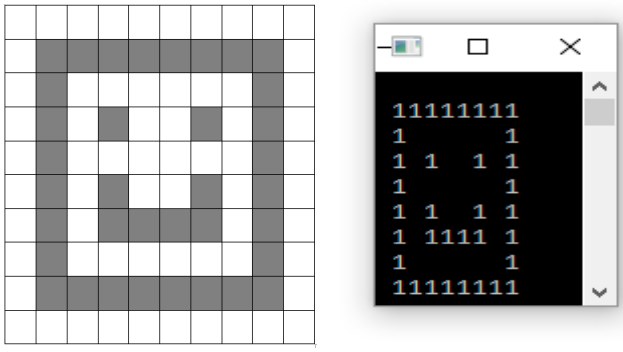


$$Image = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

The above image is your final image to be reconstructed. However, your algorithm should start with a random image. An example is given below:



In this assessment, you are first required to implement a class/function to simulate the objective function, which is the discrepancy between the two images when required. After implementing the objective function, you can then design and implement an algorithm to minimize the objective function. You can visualize each steps of optimization on the commend prompt using spaces and ones. Here is an example:



Your learning facilitator will assign you one of the following algorithms to use as the base algorithm for this problem:

- Hill climbing
- Simulating annealing
- Genetic algorithm

Note that your algorithm does not have to be complete, meaning that it does not have to find the best solution 100% of the times. You can find an approximate of the final image as long as the algorithm shows consistent improvement. You will be minimizing the objective function as much as

you can. After implementation and testing your algorithm, write a reflective analysis detailing the experience of the development process. The report needs to be at least 1000 words in length and include the following sections:

- Overview
- Justifications and elaborations on the mathematical approaches and models used to solve the cases study
- Justifications and elaborations on the programming methods and practices used to implement the mathematical approaches and models
- What went right
- What went wrong
- What you are not sure about
- Conclusion

Task Instructions

The source code that you will be submitting should be free of build warnings, build errors, and all intermediate files (.obj, .pdb, etc), crashes, and errors (compile, run-time, logical, etc.). Your code should be structured and written with the best practices in the field of programming. There should be enough number of comments in the source files to show your understanding of the program. Any third-party code should be appropriately attributed.

When you submit the electronic version of your project make sur to use the following names:

- Name the source code folder as: Source – Student Name
- Name the solution as: YourGameName.sln

Submission Instructions

You are supposed to submit a ZIP file including:

- **Release Build Zip:** A release build executable must be zipped and included with the submission. Ensure that project settings are set to Release when creating this build.
- **Source Code Zip:** All relevant source code files and project files must be zipped and included with the submission
- **Reflective report:** PDF or Word
- Naming & File structure for the zip file.
    - MFA501_Assessment3_LastName_FirstName.zip
        - Assessment3_Build_LastName_FirstName.zip
        - Assessment3_Source_LastName_FirstName.zip
        - Assessment3_report_LastName_Firstname.pdf
        - Assessment3_ report _LastName_Firstname.docx

Assessment Rubric

Assessment Attributes	Fail (Yet to achieve minimum standard) 0-49%	Pass (Functional) 50-64%	Credit (Proficient) 65-74%	Distinction (Advanced) 75-84%	High Distinction (Exceptional) 85-100%
Work demonstrates the knowledge and understanding of the best mathematical notations and representation methods in AI for the case study 35%	Little or no use of mathematical and/or problem representation techniques The implementation is mostly wrong	Acceptable use of mathematical and/or problem representation techniques, but they are not the most suitable ones for the case study and the AI model The implementation is correct but includes errors and flaws	Good use of mathematical and/or problem representation techniques, but they are occasionally not efficient for the case study and the AI model The implementation is correct but not done in an efficient manner	Very good use of mathematical and/or problem representation techniques, but they are occasionally not efficient for the case study and the AI model The implementation is efficient but do not follow the best practices in programming and AI	Excellent use of mathematical and/or problem representation techniques, but they are occasionally not efficient for the case study and the AI model Excellent implantation without any error using the best practices in programming and AI
Work demonstrates the knowledge and understanding of the most suitable calculations methods in AI for the problem 35%	Little or no use of mathematical methods and techniques The implementation is mostly wrong The AI method implemented does not give correct results	Acceptable use of mathematical and/or problem representation techniques, but they are not the most suitable ones for the case study The implementation is correct but includes errors and flaws The AI method implemented occasionally gives correct results	Good use of mathematical and/or problem representation techniques, but they are occasionally not efficient for the case study The implementation is correct but no in an efficient manner The AI method implemented gives correct results, but does not handle exceptional cases.	Very good use of mathematical and/or problem representation techniques, but they are occasionally not efficient for the case study The implementation is efficient but do not follow the best practices in programming and AI The AI method implemented gives correct results and handles exceptional cases, but it is not efficient	Excellent use of mathematical and/or problem representation techniques, but they are occasionally not efficient for the case study Excellent implantation without any error using the best practices in programming and AI The AI method implemented is highly efficient, gives correct

					results, and handles exceptional cases
The reflective essay demonstrates the knowledge and understanding of the whole process of implementing and using the mathematical models and methods to develop the AI technique and solve the case study. 30%	The reflective essay includes no or little sections and concepts required. There is no or little elaborations or justifications on the use of the mathematical models and methods to develop the AI technique and solve the case study	The reflective essay includes some of the sections and concepts required. There is little elaborations or justifications to demonstrate the knowledge and understanding of the whole process of implementing and using the mathematical models and methods to develop the AI technique and solve the case study	The reflective essay includes all the sections and concepts required. Elaborations and justifications are good but not enough to show the knowledge and thorough understanding of the whole process of implementing and using the mathematical models and methods to develop the AI technique and solve the case study	The reflective essay includes all the sections and concepts required. Elaborations and justifications are very good but not thorough and in-depth to demonstrate the mastery of the whole process of implementing and using the mathematical models and methods to develop the AI technique and solve the case study	The reflective essay includes all the sections and concepts required. Elaborations and justifications are thorough and show the mastery of the whole process of implementing and using the mathematical models and methods to solve the case study.

The following Subject Learning Outcomes are addressed in this assessment	
SLO a)	Formulate key mathematical concepts used in Artificial Intelligence.
SLO c)	Interpret and transmit standard mathematical notations and terminologies in statistics, probabilities, linear algebra, vectors, matrices, differential calculus, and logical reasoning.
SLO d)	Compute accurately standard computations in statistics, probabilities, linear algebra, vectors, matrices and differential calculus.