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### CMP9132M Programming an AI with Stochastic Actions to solve a MDP problem in a partially and fully observable environment



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**Abstract**— Programming an AI to navigate an environment is a very common occurrence in the gaming world. There are many different path finding algorithms [2] and ways this has been done. From A\*[3] to Dijkstra's algorithm [4]. The aim of this research paper is to take on such a task and use an MDP [1] approach to program an AI to survive as long as possible in arenas of varying sizes, whilst also collecting bonuses in both a deterministic and non-deterministic scenario. This is repeated for a partially observable world as well as a fully observable world while the AI is also dealing with stochastic actions [6]. The outcome of this research paper proves that an AI is more capable of effective planning and surviving longer when using MDP solutions in a deterministic scenario than it is in a non-deterministic scenario.

**Keywords**—MDP, survive, deterministic, planning, solutions, observable, Stochastic actions (key words)

#### INTRODUCTION

In order to talk about implementing a path finding algorithm we must first look at some useful terminology and words which are integrated into the decision-making process. More commonly referred to as: Complex decision making [5]. Complex decision making is all about linking decisions together. This is extremely crucial when one decision leads to another; and each decision depends on the ones before and affect the ones after [6]. Making informed decisions requires knowledge about the world around us. This is true for any time of world whether real or simulated. The level of this knowledge is discretely referred to as fully observable or partially-observable in the context of world information.

A "fully observable" world is one where we always have access to all the information about the world "all the time". A "partially observable" world is one where we do not have access to all the information about the world all the time (Simon, 2022). We may start off with some information, the rest of which may be acquired over time via exploration, or another means. However,

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