Heriot-Watt Underwater Missions Report

Introduction

In my domain file “domain.pddl” with the domain name “lucca-underwater-exploration", there is a set of types, predicates and actions carefully laid out to model an environment for underwater exploration missions. These include two primary mission “types” (further covered in the problem instances section). One of which causes an area of the problem file’s choice to be fully researched and analyzed at an underwater research base – and another which causes a sonar grid to be activated after the construction of 2 underwater research base which get power from an offshore energy generator. This report will describe the domain structure, the types of locations in the domain, and the location of the command center, as requested in the project specification.

Domain Structure

Types

In order to lessen the number of predicates in the domain & prerequisites in the actions, I decided to use types implementing inheritance. Firstly, every type inherits from the type “object”. These types include “location”, “landmarks”, “sub”, "kit," “personnel”, and “scans”. There are other types that inherit from these types, such as the types of locations including “land” and “sea” under “location” and “shallow-water” and “deep-water” under “sea”. Another example of types that inherit from the object type are types of personnel in the submarine including “pilot” and “passenger” under “personnel” and “scientist” and “engineer” under “passenger”.

Predicates

The predicates in this domain are meant to represent the state of the environment. These predicates include “adjacency” to define whether locations in the grid of possible locations are adjacent to each other, and “at” to indicate whether any given object is at a location. Other predicates include those to describe the status of the submarines, personnel, and any afflictions to a location, such as marine protection and krakens.

Actions

The actions in this domain represent the actions that both personnel and submarines are capable of. These actions include three move functions, which account for the presence of Krakens and toggles energy shields depending on whether any given location is home to one, four functions for loading and unloading personnel including both pilots and passengers, and far more for conducting surveys and research, and building power generators/energy cables/underwater research bases.

Problem Instances

General Information

Inside of all four problem instances submitted, a 3 by 4 grid is used. The first row in problems 1 and 4 is all land. In problems 2 and 3, one of the nodes in the first row is shallow water. Problems 1 and 2 both have no afflictions to any locations in the grid such as Krakens and marine protection, but problems 3 and 4 do. Differences

like these continue to demonstrate that the domain will work for any given grid structure. The location of base is always at node bb, and the base always starts with all the personnel and equipment present at its location.

Problem #1

Problem 1 has a grid layout where the first row is all land, the second row is all shallow-water, and the third and fourth rows are all deep water. There are no location afflictions in this problem, such as krakens and marine protection. The goal is to turn on the sonar array, which includes building a coastal power generator, laying two sets of cables, building two separate underwater research bases, and shipping a scientist to one of them.

Problem #2

Problem 2 has a grid layout where the first row is mostly land, with some shallow water, the second row is all shallow water, the third row is mostly deep water, with some shallow water, and the fourth row is all deep water. There are no location afflictions in this problem, such as krakens and marine protection. The goal is to analyze a location (cc), which includes which includes building a coastal power generator, laying a set of cables, building an underwater research base, and shipping a scientist to one of them, performing a research scan of location cc, and then transporting it to the underwater research base.

Problem #3

Problem 3 has a grid layout where the first row is mostly land, with some shallow water, the second row is all shallow water, the third row is mostly deep water, with some shallow water, and the fourth row is all deep water. There are both location afflictions in this grid (krakens and marine protection) at different places than in Problem #4. The Goal is to turn on the sonar array, which includes building a coastal power generator, laying two sets of cables, building two separate underwater research bases, and shipping a scientist to one of them.

Problem #4

Problem 4 has a grid layout where the first row is all land, the second row is all shallow-water, and the third and fourth rows are all deep water. There are both location afflictions in this grid (krakens and marine protection) at different places than in Problem #3. The goal is to analyze a location (dc), which includes which includes building a coastal power generator, laying a set of cables, building an underwater research base, and shipping a scientist to one of them, performing a research scan of location dc, and then transporting it to the underwater research base.

Planner Used

The planner that was used was the http://editor.planning.domains/#. I used it due to not being able to get any other ones to work on my M1 MacBook and I liked the idea of being able to edit my code online.