

335 — Algorithm Engineering — Asgwilanga Caverns, More

Project #2 — More on Searching the Great Asgwilanga Caverns

More Details, as Discussed in Lecture.

Your robot cave-explorer (bot) is in the entrance room to a large cave system. You've been told by your old wizened professor that you should stick to your colored causeways (Blue for the 335-05 section) while exploring the cave system because these are the only ones that lead to a solid project grade. Your bot doesn't speak (or see) Red or Green or Blue or Yellow, etc., so you will program the bot to follow your Asgwillanga colored sub-system rules.

The bot may be programmed for the specific colored cave sub-system which it is exploring; that is, it does not have to be programmed to be a general cave explorer bot.

The bot shall start in the most distant-from-center room (for the Blue sub-system starting cave room is 16,0,0 – or G00). Note, the professor said each cave room has an Asgwillangan "name" consisting of three non-negative integers.

The bot shall show on the web page display the room it is currently in, and the rooms it has visited along with the causeways it has traveled in going from room to room. The bot will display a room as a graph node (eg, box, oval, blob) labeled with its room-name. The bot shall display each causeway as a graph edge (eg, line, arc, squiggle) connecting the two graph nodes which represent the cave rooms at its ends (ie, the room the bot came from and the room the bot traveled to), and also indicated the causeway's direction (eg, by arrowhead, dot, splotch).

You may show on the web page display an arrangement of the explored graph nodes and directed edges in any fairly clear way you wish. Also, you may change their placement as the bot extends its exploration, as long as you delay for about one full second after such a rearrangement (to let the audience easily see what changes happened).

The bot shall only move to a room with the same name-sum as the bot's current room (the **Sum Rule**).

The bot shall only move to a room with the cave sub-system room name ID limits (Blue sub-system **ID Limits Rule** is (16, 8, 7)).

The bot shall only move to a room with one ID part being the same as that ID part of the room it just left (the **Single-Same Rule**). Note that the other two ID parts must change (because no two rooms have the same name ID) and hence one must change upward and the other one downward (because the room name ID parts must satisfy the Sum Rule).

The bot shall only move to a room where one of the changing ID parts is zero, and/or where the one of the changing ID parts is at its ID Limit (AKA max) for that part (the **Zero-Max Rule**).

The bot shall only move to a room with all the above Rules being obeyed. It is by obeying these rules for moving from one cave room to another that the bot can stay within its colored cave sub-system. Attempting to move to other cave rooms (eg, by teleportation, astral projection, quantum tunnelling, or even merely drilling new tunnels) by breaking your colored cave sub-system rules is strictly prohibited.

The bot shall show on the web page display NO nodes for rooms it has NOT visited.

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The bot shall show on the web page display NO edges for causeways it has NOT traveled.

The bot shall show on the web page display in a special easily visible way the node for the cave room it is currently in. For example, show a yellow sub-box within a graph node box (or oval, etc.), or overwrite the graph node room ID label in a different color, or overwrite the graph node background with a different color, or include a little bot triangle (or square, or circle, or bunny, etc.) icon which moves from graph node to graph node, etc. Don't forget to remove this type of highlighting of a displayed graph node when the bot moves to a different cave room.

Causeways (ie, how the Rules dictate where causeways exist) permitting, the bot may be able to travel a causeway to a cave room it has previously visited. The bot is allowed to remember and notice this in its programming. The bot is allowed to remember and keep up-to-date an entire map of the places it has visited in its travels. The bot shall not be omniscient and know about (or "remember") places it has NOT yet visited. The algorithm with which the bot is programmed shall adhere to these liberties and restrictions.

Your choice of bot algorithm is up to you. For example, DFS, BFS, Random Brute Force, Alphabetic Kid, Most-Centered Kid, etc. Your bot is specially built so that it can "back up" from its current cave room to the prior cave room along the path it has been traveling (something a real explorer could not do without specialty ropes and equipment). Note that this does not mean there is such a "back-up causeway" between those two cave rooms, so when the bot backs up, it shall NOT add a back-pointing graph edge (representing a real cave sub-system causeway) but instead it shall merely update the web page display to show the graph node representing the cave room it backed up into. The bot can back up any number of times, all the way back to the starting cave room if needed by its algorithm.

The bot shall NOT update or change the web page display more often than about once every 1/5 of a second, nor less often than about once every second. This is so the audience can easily tell what is going on with the bot during exploration.

The bot shall show on the web page display the nodes (for cave rooms) and edges (for causeways) well enough to be easily legible to the display audience. Graph edges can cross but they should be easy to follow with the eye. (If you color them, don't use both red and green colors for edges.) Also, graph nodes and their labels should not overlap, etc.

The bot shall attempt to identify the cave room (or rooms, but one will do) closest to the center of your colored cave sub-system by using the Residue Distance measure for each cave room. Each cave room's residue distance NEED NOT be shown with its graph node on the web page display. When the bot has so identified a closest cave room, the bot will indicate this in some fashion on the display, and can at that point cease its explorations and leave the display unchanged thereafter. Note that the exact center (distance = 0) cave room is not accessible from the starting cave room, so the closest you can get will have some positive distance value.