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Program 3: A* Search – Traveling in Middle-Earth

For the step one I used a simple heuristic that used only the distances. My g value was calculated using the following formula for run #1:

g = (distance from the parent node to the current node) + (distance from start to parent node.)

My h value was calculated with the following formula for run #1:

h = estimated distance from current node to the goal node

For step two, (runs 2 and 3) I used the following formula to calculate g:

g = (distance from start to parent node) + (distance from parent node to the current node * distance weight) + (the edge being traversed risk level * risk weight) + (the edge's road quality * quality weight)

Run 1 yielded the following path: Blue_Mountains, Lake_Evendim, Fornost, Rivendell, Caradhras, Carrock, Esgaroth, Iron_Hills, with F = 1255.0

In run 2, I chose the following weights: quality weight = .1, risk weight = 10, distance weight = 2. The run resulted in the following path: Blue_Mountains, Lake_Evendim, Fornost, Rivendell, North_Pass, Carrock, Esgaroth, Iron_Hills, with F = 3981.6000000000004

In run 3, I chose the following weights: quality weight = 10, risk weight = 3, distance weight = .1. The run resulted in the following path: Blue_Mountains, Grey_Havens, Sarn_Ford, Rivendell, Caradhras, Gladden_Fields, Esgaroth, Iron_Hills, with F = 4116.5

I found that altering the heuristics did end up changing my path but not all that drastically. Changing from a path using only distances to a path factoring using the weights described in run 2, resulted in a change in my path where I went to North Pass out of Rivendell instead of heading to Caradhras. This is because my heuristic will always favor low numbers and multiplying the poor road qualities by .1 still yields a small number. Using the weights in this manner still favored short paths but also favored roads

with worse road quality. In run number 3, the heuristic favored short paths along with high quality roads which is why the path ended up the way that it did.