**Assignment 2**

Team number: 16

Dheeraj Reddy Pailla: 20161053

Anshul Gupta: 20161096

**PART B**

As seen below in iteration #0, the initial state of the board consists of 2 goal states represented by -16.0 and 16.0. It also consists of one wall, represented by ‘None’.

The value iteration algorithm is run for this input state, and the output after each iteration is shown below.

Iteration #0

| 0 | 1 | 2 | 3

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0 | -16.0 | 0.0 | 0.0 | 0.0|

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1 | 0.0 | 0.0 | None | 0.0|

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2 | 1.6 | 0.0 | 0.0 | 0.0|

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3 | 0.0 | -1.6 | 0.0 | 16.0|

Iteration #1

| 0 | 1 | 2 | 3

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0 | -16.0 | -3.2 | -3.2 | -3.2|

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1 | -1.92 | -3.2 | None | -3.2|

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2 | -1.6 | -2.08 | -3.2 | 9.6|

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3 | -2.08 | -4.8 | 9.6 | 16.0|

Iteration #2

| 0 | 1 | 2 | 3

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0 | -16.0 | -6.4 | -6.4 | -6.4|

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1 | -4.992 | -5.264 | None | 3.84|

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2 | -4.88 | -5.28 | 5.232 | 10.24|

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3 | -5.168 | 3.792 | 10.24 | 16.0|

Iteration #3

| 0 | 1 | 2 | 3

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0 | -16.0 | -9.486 | -9.6 | -1.408|

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1 | -8.13 | -8.362 | None | 5.76|

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2 | -8.12 | 0.838 | 6.539 | 11.147|

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3 | -1.171 | 4.843 | 11.147 | 16.0|

Iteration #4

| 0 | 1 | 2 | 3

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0 | -16.0 | -12.449 | -6.246 | 0.307|

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1 | -11.345 | -4.178 | None | 6.87|

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2 | -3.459 | 1.68 | 7.486 | 11.369|

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3 | -0.255 | 6.286 | 11.369 | 16.0|

Iteration #5

| 0 | 1 | 2 | 3

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0 | -16.0 | -8.767 | -4.204 | 1.702|

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1 | -7.52 | -3.409 | None | 7.269|

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2 | -3.016 | 3.0 | 7.78 | 11.486|

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3 | 1.457 | 6.691 | 11.486 | 16.0|

Iteration #6

| 0 | 1 | 2 | 3

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0 | -16.0 | -7.78 | -2.679 | 2.365|

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1 | -6.706 | -1.893 | None | 7.442|

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2 | -1.406 | 3.353 | 7.915 | 11.527|

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3 | 1.997 | 6.958 | 11.527 | 16.0|

Iteration #7

| 0 | 1 | 2 | 3

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0 | -16.0 | -6.311 | -1.844 | 2.722|

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1 | -5.185 | -1.378 | None | 7.51|

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2 | -0.989 | 3.638 | 7.965 | 11.544|

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3 | 2.425 | 7.052 | 11.544 | 16.0|

Iteration #8

| 0 | 1 | 2 | 3

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0 | -16.0 | -5.444 | -1.391 | 2.896|

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1 | -4.647 | -0.946 | None | 7.537|

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2 | -0.565 | 3.74 | 7.986 | 11.551|

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3 | 2.585 | 7.104 | 11.551 | 16.0|

Iteration #9

| 0 | 1 | 2 | 3

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0 | -16.0 | -4.952 | -1.162 | 2.98|

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1 | -4.211 | -0.767 | None | 7.548|

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2 | -0.414 | 3.805 | 7.994 | 11.554|

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3 | 2.686 | 7.125 | 11.554 | 16.0|

Iteration #10

| 0 | 1 | 2 | 3

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0 | -16.0 | -4.701 | -1.048 | 3.02|

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1 | -4.029 | -0.654 | None | 7.553|

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2 | -0.309 | 3.831 | 7.998 | 11.555|

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3 | 2.727 | 7.136 | 11.555 | 16.0|

Iteration #11

| 0 | 1 | 2 | 3

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0 | -16.0 | -4.574 | -0.993 | 3.039|

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1 | -3.915 | -0.603 | None | 7.554|

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2 | -0.265 | 3.846 | 7.999 | 11.555|

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3 | 2.751 | 7.141 | 11.555 | 16.0|

After the 11th iteration, the change from iteration #11 to iteration #10 is less than or equal to 1%, hence the algorithm quits after the 11th iteration.

The optimal policy for each state is as follows:

| 0 | 1 | 2 | 3

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0 | Bad | 4 | 4 | 2|

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1 | 2 | 2 | None | 2|

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2 | 4 | 4 | 4 | 2|

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3 | 4 | 4 | 4 | Goal|

In the above policy, ‘Bad’ and ‘Goal’ represent the two end states.

The policy # to direction mapping is as follows:-

1 -> North

2 -> South

3 -> West

4 -> East

The given start state is (3, 0).

Therefore, from the optimal policy displayed above, it is clear that the optimal path is as follows: -

(3, 0) -> (3, 1) -> (3, 2) -> (3, 3)