Vaishnavi Patel

The python version I used is 3.7

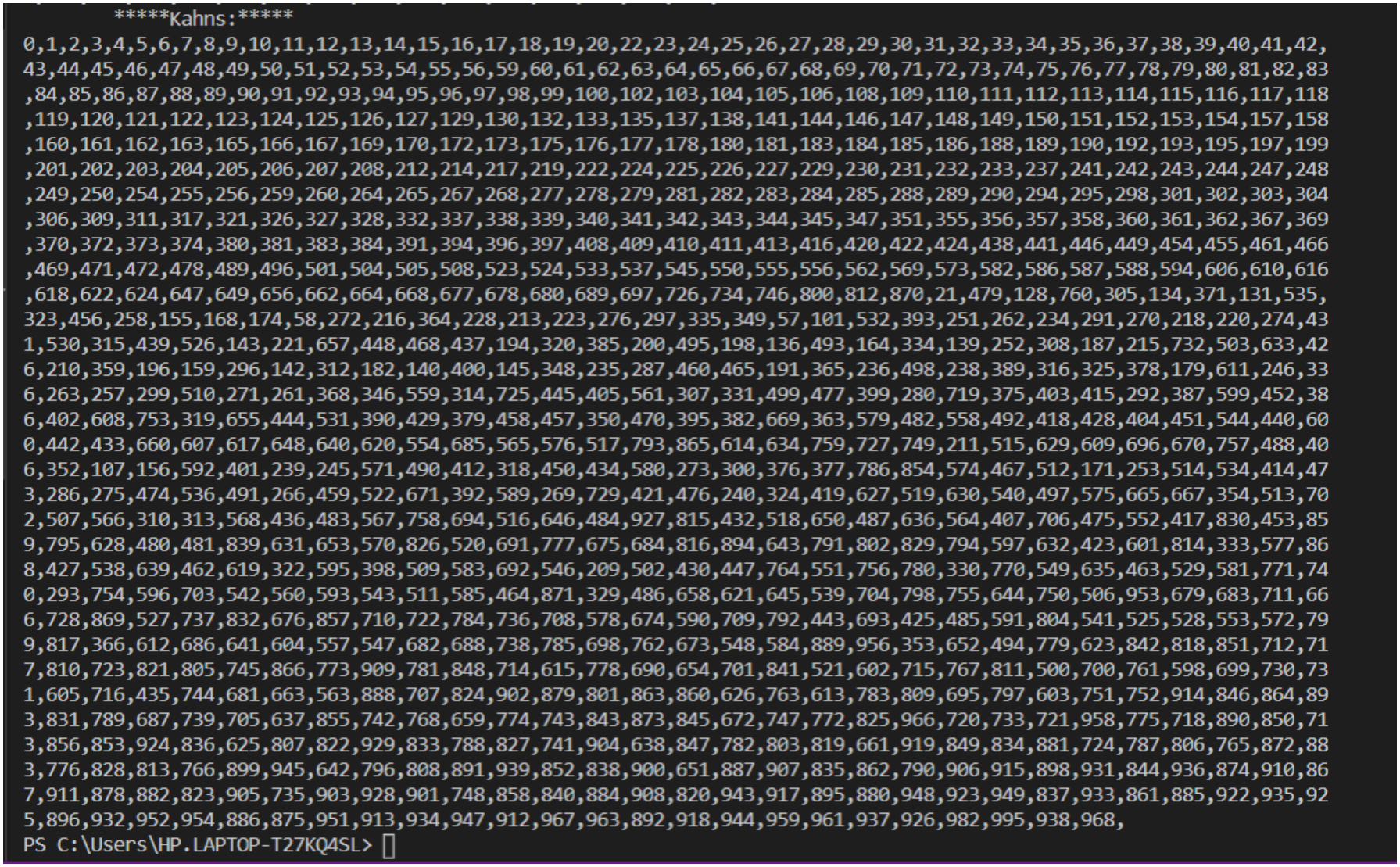
Question 4: Thank you Vertext

```
Edge:  38       has neighboring nodes:          949     230
Edge:  39       has neighboring nodes:          867     519
Edge:  40       has neighboring nodes:          259     70
Edge:  41       has neighboring nodes:          927     96
Edge:  42       has neighboring nodes:          476     998
Edge:  43       has neighboring nodes:          840     84
Edge:  44       has neighboring nodes:          552     816
Edge:  45       has neighboring nodes:          727     929
Edge:  46       has neighboring nodes:          139     127
Edge:  47       has neighboring nodes:          117     629
Edge:  48       has neighboring nodes:          97      688
Edge:  49       has neighboring nodes:          552     625
Edge:  50       has neighboring nodes:          161     636
Edge:  51       has neighboring nodes:          967     759
Edge:  52       has neighboring nodes:          390     721
Edge:  53       has neighboring nodes:          800     620
Edge:  54       has neighboring nodes:          568     714
Edge:  55       has neighboring nodes:          796     987
Edge:  56       has neighboring nodes:          718     116
Edge:  57       has neighboring nodes:          817     962
Edge:  58       has neighboring nodes:          922     909
Edge:  59       has neighboring nodes:          405     838
Edge:  60       has neighboring nodes:          201     238
Edge:  61       has neighboring nodes:          924     666
Edge:  62       has neighboring nodes:          81      908
Edge:  63       has neighboring nodes:          386     128
Edge:  64       has neighboring nodes:          593     426
Edge:  65       has neighboring nodes:          606     855
Edge:  66       has neighboring nodes:          827     740
Edge:  67       has neighboring nodes:          725     692
Edge:  68       has neighboring nodes:          167     769
Edge:  69       has neighboring nodes:          497     788
Edge:  70       has neighboring nodes:          939     344
Edge:  71       has neighboring nodes:          710     584
Edge:  72       has neighboring nodes:          669     834
Edge:  73       has neighboring nodes:          581     844
Edge:  74       has neighboring nodes:          701     945
Edge:  75       has neighboring nodes:          743     208
Edge:  76       has neighboring nodes:          582     955
Edge:  77       has neighboring nodes:          375     897
Edge:  78       has neighboring nodes:          465     291
Edge:  79       has neighboring nodes:          124     623
Edge:  80       has neighboring nodes:          246     497
Edge:  81       has neighboring nodes:          172     533
Edge:  82       has neighboring nodes:          335     557
Edge:  83       has neighboring nodes:          317     601
```

```
Edge:  960      has neighboring nodes:          986     966
Edge:  961      has neighboring nodes:          999     961
Edge:  962      has neighboring nodes:          972     977
Edge:  963      has neighboring nodes:          988     991
Edge:  964      has neighboring nodes:          978     996
Edge:  965      has neighboring nodes:          978     973
Edge:  966      has neighboring nodes:          967     999
Edge:  967      has neighboring nodes:          996     985
Edge:  968      has neighboring nodes:          989     977
Edge:  969      has neighboring nodes:          969     972
Edge:  970      has neighboring nodes:          984     976
Edge:  971      has neighboring nodes:          981     993
Edge:  972      has neighboring nodes:          993     989
Edge:  973      has neighboring nodes:          991     990
Edge:  974      has neighboring nodes:          981     987
Edge:  975      has neighboring nodes:          984     981
Edge:  976      has neighboring nodes:          976     993
Edge:  977      has neighboring nodes:          994     996
Edge:  978      has neighboring nodes:          988     980
Edge:  979      has neighboring nodes:          987     979
Edge:  980      has neighboring nodes:          984     994
Edge:  981      has neighboring nodes:          981     997
Edge:  982      has neighboring nodes:          996     987
Edge:  983      has neighboring nodes:          998     991
Edge:  984      has neighboring nodes:          987     998
Edge:  985      has neighboring nodes:          985     992
Edge:  986      has neighboring nodes:          987     997
Edge:  987      has neighboring nodes:          995     997
Edge:  988      has neighboring nodes:          990     996
Edge:  989      has neighboring nodes:          989     997
Edge:  990      has neighboring nodes:          996     992
Edge:  991      has neighboring nodes:          998     993
Edge:  992      has neighboring nodes:          995     997
Edge:  993      has neighboring nodes:          997     999
Edge:  994      has neighboring nodes:          995     999
Edge:  995      has neighboring nodes:          996     998
Edge:  996      has neighboring nodes:          999     997
Edge:  997      has neighboring nodes:          997     998
Edge:  998      has neighboring nodes:          998
Edge:  999      has neighboring nodes:          999
```

*****mDFS*****

937,866,861,756,748,712,687,684,678,677,675,673,660,657,655,647,628,627,614,603,638,590,585,57
5,569,554,548,544,707,528,542,527,518,512,511,508,507,530,506,503,502,495,493,489,587,524,488,
487,482,484,481,475,472,471,467,466,463,461,459,442,441,439,709,438,436,433,430,428,421,418,42
9,417,416,573,414,410,408,404,403,451,398,397,774,392,389,388,387,385,380,377,650,690,373,372,
370,369,610,365,360,357,356,354,353,349,347,659,345,379,343,383,355,340,339,338,336,453,334,50
0,331,496,330,329,327,555,663,324,323,321,411,320,314,325,313,312,310,309,407,307,621,303,301,
505,757,775,300,299,798,815,402,431,641,599,617,649,297,296,483,293,290,382,289,287,286,284,28
3,456,580,282,368,278,277,276,735,791,273,272,271,270,269,268,598,261,473,258,257,298,363,256,
491,326,764,255,253,274,520,662,409,679,252,288,250,249,245,243,242,241,239,574,683,237,234,22
8,394,227,248,226,224,292,378,498,689,223,221,220,531,219,534,218,217,215,213,251,711,626,212,
211,546,477,210,419,209,244,715,204,203,202,400,583,200,316,199,197,196,194,193,551,667,700,76
2,440,595,803,192,235,266,190,189,634,685,187,412,186,185,182,180,280,179,654,178,177,176,175,
174,766,173,171,486,604,616,751,170,279,306,169,448,480,168,181,166,164,264,319,413,163,578,16
0,812,158,157,156,154,153,478,152,567,151,318,517,784,818,150,295,149,184,147,722,144,532,594,
143,142,214,308,763,141,570,140,510,613,138,206,207,305,263,597,642,137,136,367,395,155,460,13
4,132,537,781,131,222,130,126,425,125,159,198,458,322,123,122,337,682,121,420,919,120,304,435,
602,765,588,119,424,736,118,523,115,572,785,114,384,113,695,878,111,563,110,107,129,229,697,10
6,135,315,536,104,183,434,516,540,103,362,101,162,100,605,99,422,648,95,786,358,479,94,108,447
,797,302,332,645,93,165,449,254,92,91,90,374,89,457,88,231,260,87,776,86,535,787,887,415,85,28
5,767,83,601,317,82,335,80,246,79,623,652,124,846,78,291,465,509,589,77,375,76,582,75,208,275,
633,719,708,826,611,779,74,73,72,669,71,584,710,69,68,167,632,65,855,64,426,593,653,608,63,128
,225,522,693,386,864,61,60,238,547,201,59,405,58,57,817,56,116,581,543,780,54,714,891,568,656,
851,53,52,390,721,769,799,51,759,50,636,161,612,834,49,625,47,629,117,195,146,46,127,191,139,4
54,188,233,45,44,552,42,476,515,680,41,96,631,724,40,70,344,446,468,615,259,808,39,519,705,772
,871,888,38,230,469,37,98,525,359,423,944,746,619,704,728,867,341,36,731,733,847,35,820,865,34
,366,553,33,32,133,443,31,236,857,596,703,752,758,30,526,809,843,381,29,492,348,813,499,28,265
,558,651,27,48,688,97,351,672,894,148,26,577,842,670,25,490,674,545,550,901,562,750,62,81,533,
609,172,576,666,342,718,923,361,702,896,907,24,497,747,770,145,352,726,755,23,67,725,706,730,2
2,761,21,333,462,566,474,20,393,606,432,464,661,844,882,564,713,869,737,19,754,810,821,18,427,
701,885,17,216,624,788,832,841,852,16,66,827,839,15,43,84,281,455,539,671,740,805,829,836,863,
565,696,346,485,840,376,504,600,14,391,691,559,579,716,745,793,105,513,586,856,13,618,622,908,
717,12,501,11,205,350,450,800,399,406,694,668,771,744,749,768,790,893,445,571,825,877,437,777,
742,10,591,592,858,898,692,9,240,630,831,364,514,723,753,637,646,897,853,738,8,232,739,247,444
,607,792,720,732,7,401,538,699,794,935,620,837,881,873,311,727,328,664,741,802,811,912,870,807
,879,6,804,822,904,934,102,452,814,823,922,549,760,884,971,640,643,729,109,644,880,952,890,262
,494,560,396,521,557,773,859,782,876,561,830,913,850,854,921,868,5,267,371,541,806,875,665,915
,949,928,743,892,783,828,886,939,947,953,833,895,845,4,556,635,676,838,639,801,849,917,905,945
,906,889,940,942,824,872,974,2,965,55,796,929,960,966,967,985,964,1,795,914,816,918,778,956,90
0,970,976,932,963,0,3,294,883,899,903,911,933,936,946,978,980,979,658,874,941,988,789,924,955,
112,470,862,902,959,681,698,848,909,926,950,954,957,930,961,916,958,927,982,734,860,943,920,96
2,948,968,977,529,819,835,975,981,984,910,931,994,969,972,989,686,951,973,990,992,925,938,983,
991,993,986,987,995,996,997,998,999,



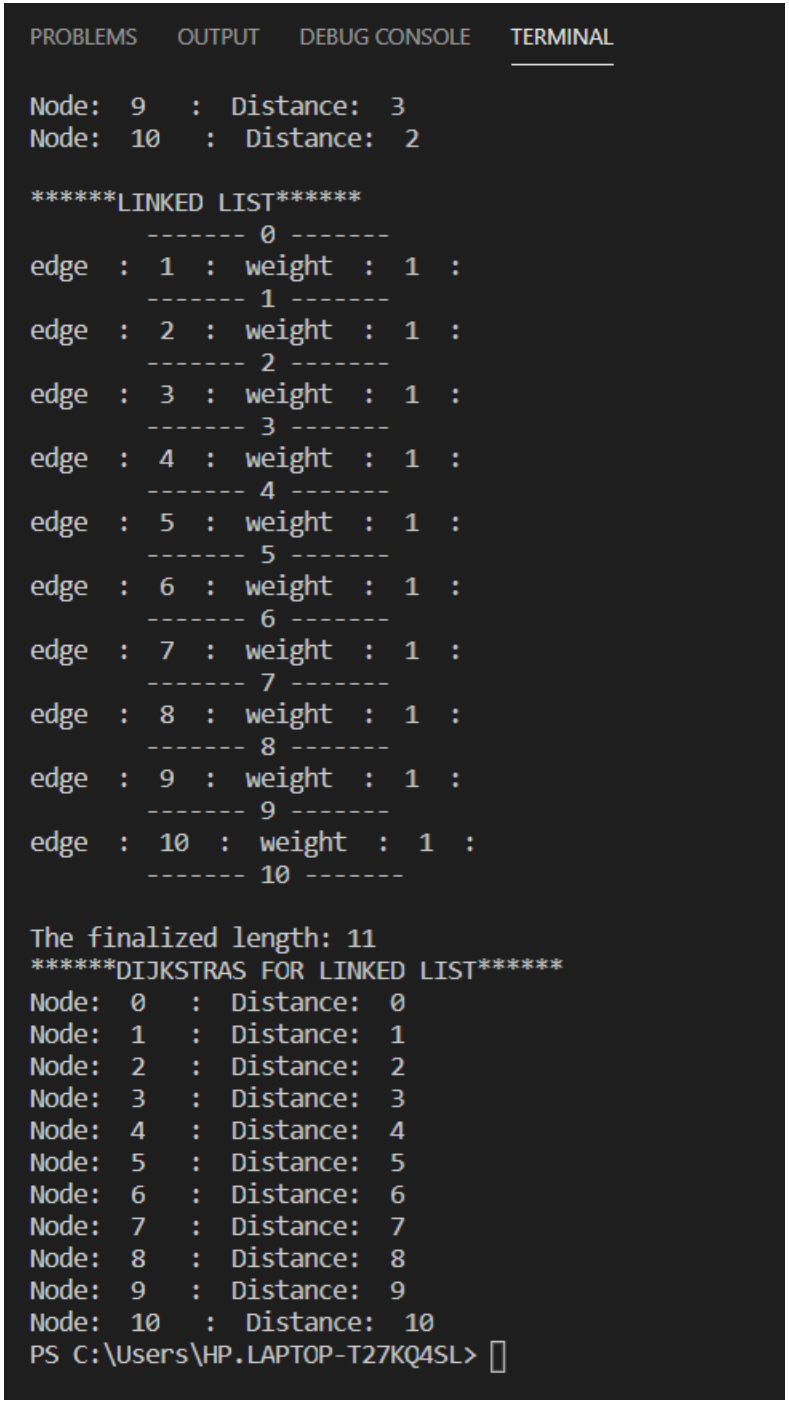
I node you want me:

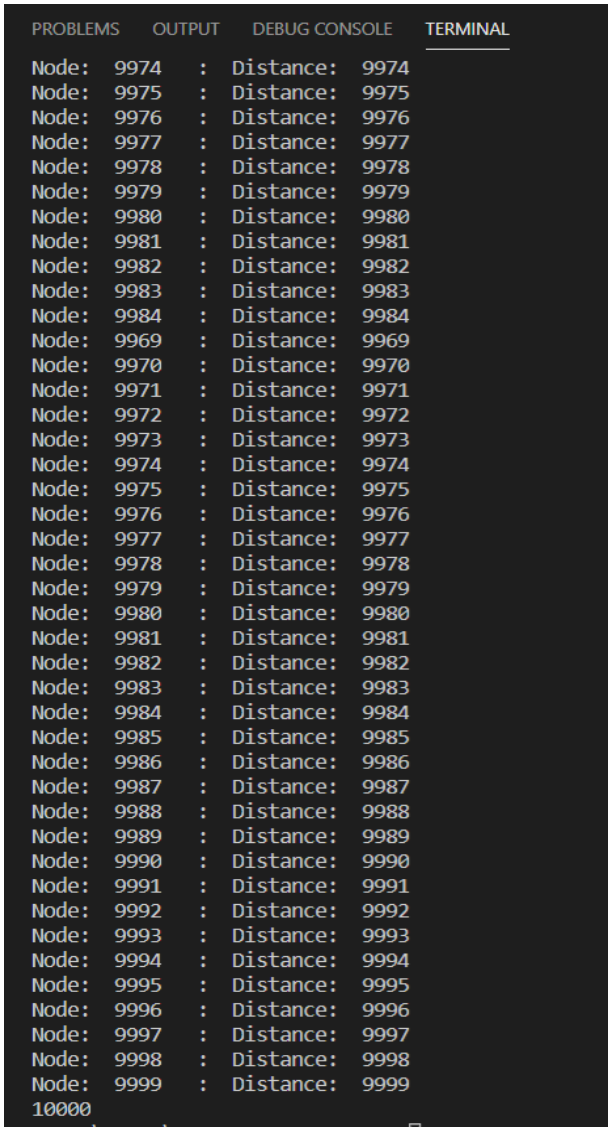
```
        ------- 0 -------
edge  :  1  :  weight  :  10  :
edge  :  2  :  weight  :  1  :
edge  :  3  :  weight  :  2  :
edge  :  4  :  weight  :  8  :
edge  :  5  :  weight  :  3  :
edge  :  6  :  weight  :  9  :
edge  :  7  :  weight  :  8  :
edge  :  8  :  weight  :  10  :
edge  :  9  :  weight  :  9  :
edge  :  10  :  weight  :  2  :
        ------- 1 -------
edge  :  0  :  weight  :  9  :
edge  :  2  :  weight  :  7  :
edge  :  3  :  weight  :  10  :
edge  :  4  :  weight  :  5  :
edge  :  5  :  weight  :  4  :
edge  :  6  :  weight  :  10  :
edge  :  7  :  weight  :  10  :
edge  :  8  :  weight  :  8  :
edge  :  9  :  weight  :  6  :
edge  :  10  :  weight  :  4  :
        ------- 2 -------
edge  :  0  :  weight  :  9  :
edge  :  1  :  weight  :  10  :
edge  :  3  :  weight  :  5  :
edge  :  4  :  weight  :  7  :
edge  :  5  :  weight  :  8  :
edge  :  6  :  weight  :  8  :
edge  :  7  :  weight  :  1  :
edge  :  8  :  weight  :  7  :
edge  :  9  :  weight  :  8  :
edge  :  10  :  weight  :  5  :
        ------- 3 -------
edge  :  0  :  weight  :  4  :
edge  :  1  :  weight  :  10  :
edge  :  2  :  weight  :  9  :
edge  :  4  :  weight  :  6  :
edge  :  5  :  weight  :  9  :
```

```
edge  :  9  :  weight  :  1  :
edge  :  10  :  weight  :  5  :
       ------- 4 -------
edge  :  0  :  weight  :  10  :
edge  :  1  :  weight  :  7  :
edge  :  2  :  weight  :  3  :
edge  :  3  :  weight  :  3  :
edge  :  5  :  weight  :  3  :
edge  :  6  :  weight  :  9  :
edge  :  7  :  weight  :  8  :
edge  :  8  :  weight  :  1  :
edge  :  9  :  weight  :  10  :
edge  :  10  :  weight  :  5  :
       ------- 5 -------
edge  :  0  :  weight  :  2  :
edge  :  1  :  weight  :  5  :
edge  :  2  :  weight  :  7  :
edge  :  3  :  weight  :  8  :
edge  :  4  :  weight  :  8  :
edge  :  6  :  weight  :  6  :
edge  :  7  :  weight  :  4  :
edge  :  8  :  weight  :  10  :
edge  :  9  :  weight  :  1  :
edge  :  10  :  weight  :  9  :
       ------- 6 -------
edge  :  0  :  weight  :  9  :
edge  :  1  :  weight  :  5  :
edge  :  2  :  weight  :  6  :
edge  :  3  :  weight  :  9  :
edge  :  4  :  weight  :  10  :
edge  :  5  :  weight  :  3  :
edge  :  7  :  weight  :  4  :
edge  :  8  :  weight  :  10  :
edge  :  9  :  weight  :  5  :
edge  :  10  :  weight  :  10  :
       ------- 7 -------
edge  :  0  :  weight  :  4  :
edge  :  1  :  weight  :  3  :
edge  :  2  :  weight  :  10  :
edge  :  3  :  weight  :  4  :
edge  :  4  :  weight  :  6  :
```

```
edge  :  7  :  weight  :  3  :
edge  :  9  :  weight  :  10  :
edge  :  10  :  weight  :  2  :
        ------- 9 -------
edge  :  0  :  weight  :  3  :
edge  :  1  :  weight  :  8  :
edge  :  2  :  weight  :  4  :
edge  :  3  :  weight  :  5  :
edge  :  4  :  weight  :  3  :
edge  :  5  :  weight  :  5  :
edge  :  6  :  weight  :  6  :
edge  :  7  :  weight  :  6  :
edge  :  8  :  weight  :  8  :
edge  :  10  :  weight  :  4  :
        ------- 10 -------
edge  :  0  :  weight  :  10  :
edge  :  1  :  weight  :  10  :
edge  :  2  :  weight  :  10  :
edge  :  3  :  weight  :  1  :
edge  :  4  :  weight  :  9  :
edge  :  5  :  weight  :  5  :
edge  :  6  :  weight  :  5  :
edge  :  7  :  weight  :  7  :
edge  :  8  :  weight  :  1  :
edge  :  9  :  weight  :  4  :
The finalized length: 11
******DIJKSTRAS ALGORITHM FOR RANDOM GRAPH******
Node:  0   :  Distance:  0
Node:  1   :  Distance:  5
Node:  2   :  Distance:  1
Node:  3   :  Distance:  2
Node:  4   :  Distance:  4
Node:  5   :  Distance:  3
Node:  6   :  Distance:  4
Node:  7   :  Distance:  2
Node:  8   :  Distance:  3
Node:  9   :  Distance:  3
Node:  10   :  Distance:  2

******LINKED LIST******
        ------- 0 -------
```


PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
Node: 9 : Distance: 3
Node: 10 : Distance: 2
******LINKED LIST******
------- 0 -------
edge : 1 : weight : 1 :
------- 1 -------
edge : 2 : weight : 1 :
------- 2 -------
edge : 3 : weight : 1 :
------- 3 -------
edge : 4 : weight : 1 :
------- 4 -------
edge : 5 : weight : 1 :
------- 5 -------
edge : 6 : weight : 1 :
------- 6 -------
edge : 7 : weight : 1 :
------- 7 -------
edge : 8 : weight : 1 :
------- 8 -------
edge : 9 : weight : 1 :
------- 9 -------
edge : 10 : weight : 1 :
------- 10 -------
The finalized length: 11
******DIJKSTRAS FOR LINKED LIST******
Node: 0 : Distance: 0
Node: 1 : Distance: 1
Node: 2 : Distance: 2
Node: 3 : Distance: 3
Node: 4 : Distance: 4
Node: 5 : Distance: 5
Node: 6 : Distance: 6
Node: 7 : Distance: 7
Node: 8 : Distance: 8
Node: 9 : Distance: 9
Node: 10 : Distance: 10
PS C:\Users\HP.LAPTOP-T27KQ4SL>


PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
Node: 9974 : Distance: 9974
Node: 9975 : Distance: 9975
Node: 9976 : Distance: 9976
Node: 9977 : Distance: 9977
Node: 9978 : Distance: 9978
Node: 9979 : Distance: 9979
Node: 9980 : Distance: 9980
Node: 9981 : Distance: 9981
Node: 9982 : Distance: 9982
Node: 9983 : Distance: 9983
Node: 9984 : Distance: 9984
Node: 9969 : Distance: 9969
Node: 9970 : Distance: 9970
Node: 9971 : Distance: 9971
Node: 9972 : Distance: 9972
Node: 9973 : Distance: 9973
Node: 9974 : Distance: 9974
Node: 9975 : Distance: 9975
Node: 9976 : Distance: 9976
Node: 9977 : Distance: 9977
Node: 9978 : Distance: 9978
Node: 9979 : Distance: 9979
Node: 9980 : Distance: 9980
Node: 9981 : Distance: 9981
Node: 9982 : Distance: 9982
Node: 9983 : Distance: 9983
Node: 9984 : Distance: 9984
Node: 9985 : Distance: 9985
Node: 9986 : Distance: 9986
Node: 9987 : Distance: 9987
Node: 9988 : Distance: 9988
Node: 9989 : Distance: 9989
Node: 9990 : Distance: 9990
Node: 9991 : Distance: 9991
Node: 9992 : Distance: 9992
Node: 9993 : Distance: 9993
Node: 9994 : Distance: 9994
Node: 9995 : Distance: 9995
Node: 9996 : Distance: 9996
Node: 9997 : Distance: 9997
Node: 9998 : Distance: 9998
Node: 9999 : Distance: 9999
10000

```
 95    for node in nodes:print("Node: ", node.name, "   :  Distance: "
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL

```
Node:  9961   :  Distance:  9961
Node:  9962   :  Distance:  9962
Node:  9963   :  Distance:  9963
Node:  9964   :  Distance:  9964
Node:  9965   :  Distance:  9965
Node:  9966   :  Distance:  9966
Node:  9967   :  Distance:  9967
Node:  9968   :  Distance:  9968
Node:  9969   :  Distance:  9969
Node:  9970   :  Distance:  9970
Node:  9971   :  Distance:  9971
Node:  9972   :  Distance:  9972
Node:  9973   :  Distance:  9973
Node:  9974   :  Distance:  9974
Node:  9975   :  Distance:  9975
Node:  9976   :  Distance:  9976
Node:  9977   :  Distance:  9977
Node:  9978   :  Distance:  9978
Node:  9979   :  Distance:  9979
Node:  9980   :  Distance:  9980
Node:  9981   :  Distance:  9981
Node:  9982   :  Distance:  9982
Node:  9983   :  Distance:  9983
Node:  9984   :  Distance:  9984
Node:  9985   :  Distance:  9985
Node:  9986   :  Distance:  9986
Node:  9987   :  Distance:  9987
Node:  9988   :  Distance:  9988
Node:  9989   :  Distance:  9989
Node:  9990   :  Distance:  9990
Node:  9991   :  Distance:  9991
Node:  9992   :  Distance:  9992
Node:  9993   :  Distance:  9993
Node:  9994   :  Distance:  9994
Node:  9995   :  Distance:  9995
Node:  9996   :  Distance:  9996
Node:  9997   :  Distance:  9997
Node:  9998   :  Distance:  9998
Node:  9999   :  Distance:  9999
Number of Nodes finalized in dijstras:  10000
PS C:\Users\HP.LAPTOP-T27KQ4SL>
```

Question: Wish upon a star

```
GRID[ 90 , 89 ]  =   8990
GRID[ 91 , 89 ]  =   8991
GRID[ 92 , 89 ]  =   8992
GRID[ 93 , 89 ]  =   8993
GRID[ 94 , 89 ]  =   8994
GRID[ 95 , 89 ]  =   8995
GRID[ 96 , 89 ]  =   8996
GRID[ 97 , 89 ]  =   8997
GRID[ 98 , 89 ]  =   8998
GRID[ 99 , 89 ]  =   8999
GRID[ 0 , 90 ]  =   9000
GRID[ 1 , 90 ]  =   9001
GRID[ 2 , 90 ]  =   9002
GRID[ 3 , 90 ]  =   9003
GRID[ 4 , 90 ]  =   9004
GRID[ 5 , 90 ]  =   9005
GRID[ 6 , 90 ]  =   9006
GRID[ 7 , 90 ]  =   9007
GRID[ 8 , 90 ]  =   9008
GRID[ 9 , 90 ]  =   9009
GRID[ 10 , 90 ]  =   9010
GRID[ 11 , 90 ]  =   9011
GRID[ 12 , 90 ]  =   9012
GRID[ 13 , 90 ]  =   9013
GRID[ 14 , 90 ]  =   9014
GRID[ 15 , 90 ]  =   9015
GRID[ 16 , 90 ]  =   9016
GRID[ 17 , 90 ]  =   9017
GRID[ 18 , 90 ]  =   9018
GRID[ 19 , 90 ]  =   9019
GRID[ 20 , 90 ]  =   9020
GRID[ 21 , 90 ]  =   9021
GRID[ 22 , 90 ]  =   9022
GRID[ 23 , 90 ]  =   9023
GRID[ 24 , 90 ]  =   9024
GRID[ 25 , 90 ]  =   9025
GRID[ 26 , 90 ]  =   9026
GRID[ 27 , 90 ]  =   9027
GRID[ 28 , 90 ]  =   9028
GRID[ 29 , 90 ]  =   9029
GRID[ 30 , 90 ]  =   9030
GRID[ 31 , 90 ]  =   9031
GRID[ 32 , 90 ]  =   9032
GRID[ 33 , 90 ]  =   9033
GRID[ 34 , 90 ]  =   9034
GRID[ 35 , 90 ]  =   9035
```

```
GRID[ 44 , 94 ]  =   9444
GRID[ 45 , 94 ]  =   9445
GRID[ 46 , 94 ]  =   9446
GRID[ 47 , 94 ]  =   9447
GRID[ 48 , 94 ]  =   9448
GRID[ 49 , 94 ]  =   9449
GRID[ 50 , 94 ]  =   9450
GRID[ 51 , 94 ]  =   9451
GRID[ 52 , 94 ]  =   9452
GRID[ 53 , 94 ]  =   9453
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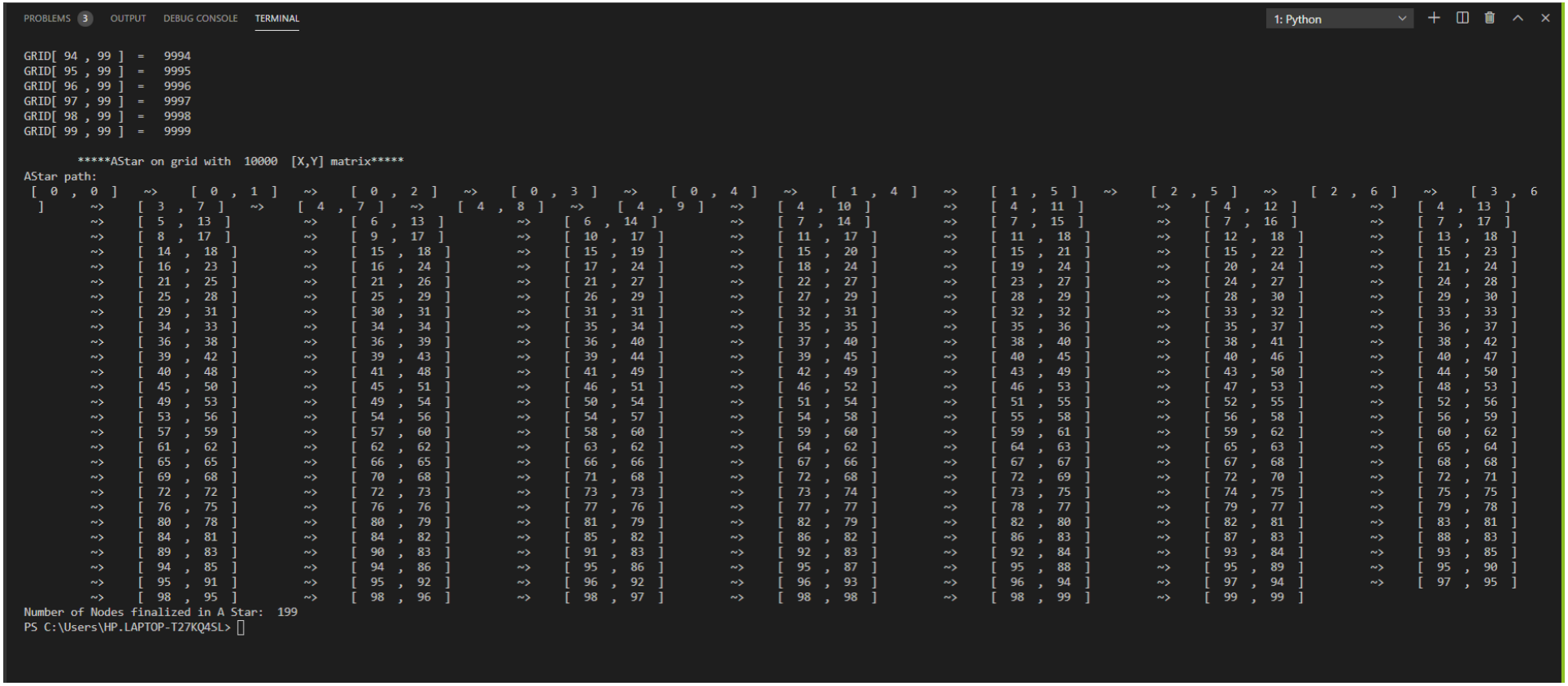

Extra Credit:

Size = 10000

Number of Nodes finalized in Dijkstra's = 10000

Number of Nodes finalized in A Star = 199

Yes, there is a big difference in numbers between the two searches. A* goes through less nodes when determining the path while Dijkstra's visits all nodes.