WK02\Assignment02_binary_search.py

```python
1   # Python 3.12
2
3   # Generate an ordered array of length <= 100; 1 and 10000 included as end point extremes
4   import random
5   a=[1]
6   for i in range(2000):
7       if random.randint(0,10) == 5:
8           a.append(1000+i)
9       if len(a) == 99:
10          break
11  a.append(10000)
12  print(a) # optional print statement to check the array values
13
14  # Randomly select the target from the list
15  target = a[random.randint(0,len(a)-1)] # 1 or 10000 to test ends, 0 or 99999 to test fail
16  print('\nTarget value:\t\t', target)
17  # store starting length of the array
18  length = len(a)
19  print('Size of array "a":\t', len(a))
20  # set a variable to keep track of the upper index of the array to be searching through
21  top = length
22  # set a variable to keep track of the lower index of the array to be searching through
23  floor = 0
24  # set initial guess to the index of the center most element, rounded down
25  guess = int(length*.5)
26  # initialize count variable to keep track of the number of iterations to find the target
27  count = 0
28
29  # infinite loop until a break is encountered
30  while True:
31      # iterate the count variable
32      count += 1
33      # if statement to check if the value of the array "a" at index "guess" is equal to,
34      # greater than or less than the target value
35
36      if len(a) == 1: # special case for when there is only one element in the array
37          if a[0] == target:
38              guess = 0
39              print('\nIndex ', guess, ', "a[guess]", holds ', a[guess], ' which should be equal
    to the "target" value, ', target, '. It took ', count, ' guesses to find the target.\n', sep='')
40              break
41          else:
42              print('Target not found after', count, 'guesses.')
43              break
44      # check the special case where it takes the maximum number of tries to find
45      # the target, where the floor and top variables are neighboring indexes
46      elif floor == top - 1:
47          if a[guess-1] == target: # confirm the found value is indeed the target
```

```python
48              guess = guess - 1
49              print('\nIndex ', guess, ', "a[guess]", holds ', a[guess], ' which should be equal
    to the "target" value, ', target, '. It took ', count, ' guesses to find the target.\n', sep='')
50              break
51          else:
52              print('Target not found after', count, 'guesses.')
53              break
54      elif a[guess] == target:
55          print('\nIndex ', guess, ', "a[guess]", holds ', a[guess], ' which should be equal to
    the "target" value, ', target, '. It took ', count, ' guesses to find the target.\n', sep='')
56          break
57      elif a[guess] < target:
58          floor = guess # update the floor value so future guesses don't go below it
59          length = len(a[guess:top]) # calculate the remaining number of values to check
60          guess = int(guess+(length//2)) # update guess to a value between guess and top
61      else:
62          top = guess # update the top value so future guesses don't go above it
63          length = len(a[floor:guess]) # calculate the remaining number of values to check
64          guess = int(guess-(length//2)) # update guess to a value between guess and floor
```

```
PS G:\My Drive\School\01_Fall2024\CS210\WK02> ls


    Directory: G:\My Drive\School\01_Fall2024\CS210\WK02


Mode                 LastWriteTime         Length Name
----                 -------------         ------ ----
------         9/4/2024   4:57 PM           3097 Assignment02_binary_search.py
------         9/4/2024   4:22 PM           1232
Assignment02_binary_search_OUTPUT.txt
------         9/4/2024   4:57 PM         146902 Assignment02_binary_search.pdf


PS G:\My Drive\School\01_Fall2024\CS210\WK02> py .\Assignment02_binary_search.py
[1, 1023, 1045, 1051, 1058, 1065, 1071, 1100, 1112, 1114, 1122, 1163, 1166, 1176,
1178, 1189, 1197, 1214, 1225, 1247, 1248, 1255, 1256, 1271, 1277, 1282, 1295, 1303,
1304, 1307, 1310, 1318, 1327, 1328, 1329, 1356, 1374, 1377, 1392, 1394, 1412, 1428,
1432, 1437, 1448, 1478, 1483, 1487, 1498, 1499, 1503, 1528, 1532, 1534, 1535, 1537,
1553, 1555, 1556, 1566, 1577, 1584, 1593, 1596, 1619, 1620, 1632, 1638, 1649, 1652,
1658, 1664, 1678, 1693, 1699, 1704, 1745, 1760, 1765, 1766, 1787, 1795, 1802, 1815,
1822, 1846, 1874, 1883, 1900, 1909, 1924, 1952, 1957, 1959, 1960, 1962, 1966, 1968,
1970, 10000]

Target value:          1959
Size of array "a":     100

Index 93, "a[guess]", holds 1959 which should be equal to the "target" value, 1959.
It took 4 guesses to find the target.

PS G:\My Drive\School\01_Fall2024\CS210\WK02>
```

WK02\Assignment02_binary_search_Rev2.py

```python
1   # Python 3.12
2
3   import random
4
5   def bin_search(nums, target):
6       lowIndex = 0
7       highIndex = len(nums)-1
8       count = 0
9
10      while lowIndex <= highIndex:
11          count += 1
12          guess = (lowIndex + highIndex)//2
13          if nums[guess] == target:
14              return guess, count
15          elif nums[guess] < target:
16              lowIndex = guess + 1
17          else:
18              highIndex = guess - 1
19      return -1, count
20
21  a=[1]
22  for i in range(2000):
23      if random.randint(0,10) == 5:
24          a.append(1000+i)
25      if len(a) == 99:
26          break
27  a.append(10000)
28  print(a)
29
30  target = a[random.randint(0,len(a)-1)]
31  if random.randint(0,1) == 1:
32      target = 0
33
34  solution, iterations = bin_search(a,target)
35
36  if solution != -1:
37      print('\nTarget:', target, 'found at index:', solution, '( check:', a[solution], ') after',
    iterations, 'guesses.\n')
38  else:
39      print('\nTarget:', target, 'not found in the array after', iterations, 'guesses.\n')
```

```
PS G:\My Drive\School\01_Fall2024\CS210\WK02> ls


    Directory: G:\My Drive\School\01_Fall2024\CS210\WK02


Mode                 LastWriteTime         Length Name
----                 -------------         ------ ----
------         9/4/2024   4:57 PM           3097 Assignment02_binary_search.py
------         9/4/2024   4:58 PM           1403
Assignment02_binary_search_OUTPUT.txt
------         9/4/2024   4:57 PM         146902 Assignment02_binary_search.pdf
------         9/4/2024   6:03 PM            968 Assignment02_binary_search_Rev2.py
------         9/4/2024   6:03 PM         105466
Assignment02_binary_search_Rev2.pdf
------         9/4/2024   5:36 PM           1555
Assignment02_binary_search_Rev2_OUTPUT.txt
------         9/4/2024   6:00 PM          56569
Assignment02_binary_search_OUTPUT.pdf
------         9/4/2024   6:00 PM          56171
Assignment02_binary_search_Rev2_OUTPUT.pdf
------         9/4/2024   6:01 PM         212255
Assignemnt02_binary_search_FINAL.pdf


PS G:\My Drive\School\01_Fall2024\CS210\WK02> py
.\Assignment02_binary_search_Rev2.py
[1, 1003, 1025, 1038, 1040, 1046, 1047, 1048, 1053, 1060, 1091, 1119, 1120, 1130,
1140, 1141, 1165, 1170, 1174, 1180, 1187, 1192, 1268, 1274, 1284, 1321, 1325, 1333,
1341, 1350, 1352, 1362, 1365, 1366, 1367, 1381, 1398, 1405, 1416, 1422, 1451, 1457,
1481, 1486, 1493, 1521, 1531, 1563, 1579, 1586, 1590, 1623, 1635, 1642, 1645, 1649,
1666, 1683, 1691, 1700, 1708, 1721, 1725, 1741, 1746, 1758, 1792, 1797, 1803, 1813,
1840, 1851, 1874, 1875, 1880, 1893, 1897, 1907, 1910, 1917, 1923, 1927, 1932, 1959,
1976, 1978, 1983, 1988, 1991, 2005, 2023, 2025, 2035, 2055, 2062, 2092, 2105, 2130,
2152, 10000]

Target: 1645 found at index: 54 ( check: 1645 ) after 7 guesses.

PS G:\My Drive\School\01_Fall2024\CS210\WK02> py
.\Assignment02_binary_search_Rev2.py
[1, 1015, 1046, 1052, 1074, 1091, 1092, 1094, 1096, 1107, 1113, 1122, 1144, 1187,
1213, 1218, 1226, 1239, 1241, 1243, 1258, 1265, 1279, 1283, 1297, 1316, 1320, 1341,
1345, 1362, 1365, 1366, 1375, 1377, 1403, 1407, 1409, 1447, 1452, 1457, 1463, 1470,
1476, 1478, 1500, 1510, 1517, 1539, 1542, 1564, 1576, 1588, 1611, 1612, 1615, 1616,
1623, 1638, 1640, 1644, 1663, 1666, 1673, 1675, 1682, 1687, 1709, 1710, 1713, 1721,
1729, 1730, 1731, 1753, 1761, 1773, 1776, 1807, 1808, 1848, 1849, 1880, 1896, 1900,
1919, 1922, 1945, 1956, 1958, 1982, 1986, 1993, 2026, 2047, 2090, 2094, 2112, 2123,
2149, 10000]

Target: 1731 found at index: 72 ( check: 1731 ) after 6 guesses.
```

```
PS G:\My Drive\School\01_Fall2024\CS210\WK02> py
.\Assignment02_binary_search_Rev2.py
[1, 1004, 1012, 1022, 1029, 1040, 1067, 1073, 1080, 1087, 1117, 1123, 1134, 1154,
1155, 1156, 1157, 1169, 1170, 1182, 1188, 1192, 1202, 1228, 1235, 1251, 1267, 1268,
1271, 1308, 1311, 1312, 1314, 1315, 1330, 1331, 1334, 1352, 1372, 1375, 1408, 1427,
1433, 1435, 1448, 1462, 1463, 1494, 1507, 1519, 1532, 1544, 1572, 1587, 1593, 1603,
1614, 1641, 1645, 1657, 1660, 1664, 1668, 1669, 1674, 1680, 1681, 1684, 1706, 1709,
1726, 1750, 1771, 1774, 1776, 1784, 1785, 1792, 1843, 1844, 1854, 1865, 1869, 1876,
1901, 1904, 1905, 1945, 1957, 1978, 1988, 1999, 2008, 2010, 2017, 2026, 2040, 2045,
2064, 10000]

Target: 0 not found in the array after 6 guesses.

PS G:\My Drive\School\01_Fall2024\CS210\WK02>
```