# Linear Probe At 50 Percent Fill Using Given Hash Function

**E = ( 1 - α / 2 ) / ( 1 - α ) where α equals number of keys in the table divided by table size. At 50 percent fill, number of keys in the table are 64 and the size of the table is 128, this would make α equal 0.5 and E would equal 1.5 probes on average. The reason the actual results fail to reach the theoretical results is due to how linear probing creates concentrated clusters in a hash table as it tries to work around a collision by checking the next available slot after the original hash function. This in turn increases the probe count as each subsequent collision might have possibly doubled the collision for the next key to be placed.**

# Linear Probe At 90 Percent Fill Using Given Hash Function

**E = ( 1 - α / 2 ) / ( 1 - α ) where α equals number of keys in the table divided by table size. At 90 percent fill, number of keys in the table are 116 and the size of the table is 128, this would make α equal 0.9 and E would equal 5.5 probes on average. The reason the actual results fail to reach the theoretical results is due to how linear probing creates concentrated clusters in a hash table as it tries to work around a collision by checking the next available slot after the original hash function. This in turn increases the probe count as each subsequent collision might have possibly doubled the collision for the next key to be placed. At nearly capacity, the linear probe starts showing a crazy number of collisions.**

# Random Probe At 50 Percent Fill Using Given Hash Function

**E = - ( 1 / α ) ln ( 1 - α ) ) where α equals number of keys in the table divided by table size. At 50 percent fill, number of keys in the table are 64 and the size of the table is 128, this would make α equal 0.5 and E would equal 1.39 probes on average. The random probe does come close and beat the theoretical probability on the first 30 keys by being an avg of 1 but does go up to four on the last 30 as more collisions start to occur.**

# Random Probe At 90 Percent Fill Using Given Hash Function

**E = - (1 / α ) ln ( 1 - α ) ) where α equals number of keys in the table divided by table size. At 90 percent fill, number of keys in the table are 116 and the size of the table is 128, this would make α equal 0.9 and E would equal 2.56 probes on average. The random probe does come close and beat the theoretical probability on the first 30 keys again by being an average of 1 but does go up to eight on the last 30 as more collisions start to occur.**