Lab exercise for Oct 7 2022

You are required to build a HASH TABLE based system that allows for (key, value) pairs to be stored and managed, using operations INSERT, DELETE, SEARCH of the kind discussed in class.

1. Assume that the application relates to storing/managing information of students at IIITD.
2. The key is their 7 digit roll no. ranging in the range 200001 through 209999 and the value is a 10 digit phone no.
3. It is expected that in the years gone by and years to come we will have a total of no more than 10,000 students studying at IIITD.
4. We will use an appropriate size (viz. m) of Hash table. But wait this m is somehow related to the m we use in the has function. Net-net the resulting load factor better be < 1.
5. We will use the hash function h(k) = k mod m, where m is a large enough prime no.
6. We will experiment with quadratic probing as a way to address collisions.
7. Functions that you will necessarily develop and program include:
   1. Create an empty database, with no (key, value) pairs,
   2. INSERT an element (roll\_no, phone\_no)
   3. SEARCH an element (roll\_no, --), where ‘—‘ means any value, and return the corresponding phone\_no
   4. DELETE an element (roll\_no, --), where ‘—‘ means any value.
8. As for the executable statements, here is a possible sequence of operations:
   1. Create a new (and empty) database IIITD
   2. INSERT ONE thousand elements of form (roll\_no, phone\_no), where the keys are generated using a pseudo random no. generator, in range 200001 through 209999. To do so, create a random set of 1,000 keys and associated phone nos.
   3. SEARCH for one hundred elements of form (roll\_no, -- ), where half the keys are those that should be in the database, and others are not there in the database.
   4. DELETE one hundred elements, 50 of which should be those that you expect to be in the database, while the remaining throw up an error message.
   5. SEARCH for some 50 of those that you expect to be in the database, and another 50 that you do not expect to be in the database.
9. Finally, for the m that you have chosen, we should be able to keep count of how many times did one succeed inserting in cell/slot h(k), or in h(k) + 1, or h(k) +2, etc.
10. REPEAT the above with m reduced to half.
11. Lastly prepare a report (together with some 5 to 8 slides) on what you did, and what came out of it.