8 Algorithms (FMS)

This question is about hash tables.

(a) Briefly explain hash functions, hash tables and collisions. [3 marks]

(b) Explain the open addressing strategy of collision resolution and the term probing sequence used in that context. [3 marks]

(c) Explain quadratic probing and its advantages and disadvantages. [Hint: refer to primary and secondary clustering.] [3 marks]

(d) Give a general mathematical expression for the probing function \( p(k, i) \) used in quadratic probing. The expression should yield a 0-based index into the table, referencing the key \( k \), the probe number \( i \), the hash function \( h \), the table size \( m \) and the constants \( c_1 \) and \( c_2 \). [3 marks]

(e) Does the following pseudocode implement a form of quadratic probing? If so, derive values for \( c_1 \) and \( c_2 \) in the equation you produced for part (d). If not, prove it doesn’t. In either case, clearly justify your reasoning. [8 marks]

```python
def get(k):
    j = h(k)
    i = 0
    while True:
        if T[j].key == null: raise NotFound
        if T[j].key == k: return T[j].payload
        i = i+1
        if i == m: raise NotFound
        j = (i+j) mod m
```