Problem HT-3 (2 parts)

Hash Table Implementation

```c
#define INITNUMBUCKETS 5
#define LINKBLOCKSIZE 16
#define RESIZERATIO 1
#define NOMATCH -1
#define DEBUG 0

typedef struct Link {
    int Key;
    int Value;
    struct Link *Next;
} Link;

typedef struct {
    Link **Buckets;
    int NumBuckets;
    Link *FreeLinks;
    int Size;
} HashTable;

void Insert(HashTable *HT, int Key, int Value) {
    Link *FoundLink;
    FoundLink = Find_Key(HT, Key);
    if (FoundLink != NULL)
        FoundLink->Value = Value;
    else {
        if (HT->FreeLinks == NULL)
            HT->FreeLinks = Make_New_Links();
        FoundLink = HT->FreeLinks;
        HT->FreeLinks = HT->FreeLinks->Next;
        FoundLink->Key = Key;
        FoundLink->Value = Value;
        FoundLink->Next = HT->Buckets[Hash(HT, Key)];
        HT->Buckets[Hash(HT, Key)] = FoundLink;
        HT->Size += 1;
        if (HT->Size > HT->NumBuckets * RESIZERATIO)
            Resize_Hash_Table(HT);
    }
}

Part A: Complete the C function Find_Key that searches the hash table for an entry corresponding to a specified key. It should return a pointer to the matching Link entry if the key is found or return NULL if the key is not found in the hash table.

```c
Link *Find_Key(HashTable *HT, int Key) {
    Link *ThisLink;
    int Index;
    int Hash(HashTable *HT, int Key);
    Index = Hash(HT, Key);
    ThisLink = HT->Buckets[Index];
    while (ThisLink != NULL && ThisLink->Key != Key)
        ThisLink = ThisLink->Next;
    return ThisLink;
}
```

Part B: The following questions are related to the hash table implementation listed above.

When Insert is called more than once with the same key, what occurs?  
value replacement

Where is a new entry link placed on the bucket list?  
It is pushed onto the front of the list.

What is the range of possible values for average bucket list length?  
0 - 1

Describe the type of Buckets in HashTable (in 10 words or less).  
an array of pointers to link structures

What is the size (in bytes) of HashTable?  
4 \times 4 = 16 bytes

What is the size (in bytes) of the initial Buckets array?  
5 \times 4 = 20 bytes