QUESTION 1 (12 points). Suppose a dynamic storage allocation program that uses the buddy system has a total of 64 units of memory to allocate. Suppose the following transactions occur:

1. Process P1 requests 16 units of memory.
2. Process P2 requests 8 units of memory.
3. Process P3 requests 8 units of memory.
4. Process P4 requests 8 units of memory.
5. Process P5 requests 8 units of memory.
6. Process P6 requests 8 units of memory.
7. Process P3 returns its memory.

For each of the above, show: (i) start address and size of the block allocated to the process (for allocation requests) and (ii) the state of the array maintained by the buddy system at the immediately after processing of each of the above transactions. This means that you must show each node in the linked lists associated with the entries in the array.

During insertion, whenever there is a choice of which of two buddies are to be split, you must split the buddy with the smaller start address.

QUESTION 2 (8 points). Consider double hashing using the primary hash function \( h(K) = K \mod 10 \) and \( g(K) = K \mod 7 \). Insert the following keys into a hash table of size 10 (labeled 0 through 9) using Brent’s method for reorganizing hash tables.

15, 16, 17, 18, 19, 57, 47.

Show what the hash table looks like after each of the above keys has been inserted.