Report

1)

The question is solved using semaphores.2 semaphores full and empty are used to keep track of empty and full slots in the buffer.An array of buff size is maintained to hold the numbers produced.First the producer waits for an empty slot in the buffer and fills it if there is one.The consumer waits till a slot is full and reads it if it did'nt read the number in the slot till then. Another struct is created to keep track of the total number of distinct consumers which visited each slot.Using appropraite if and flags the consumers wont consume those slots which they have already consumed unless they are overwritten newly,and the slots are overwritten checking the array which keep hold of tot consumers visited.a mod function is used to create a circular buffer. Another array is used which tells if a particular consumer has visited a particular slot are not.

2)

The question is solved using 1 semaphore which keeps track of the number of empty slots.Firstly the buffsize and the number of soldiers are taken as input,and n soldier threads are created.They are randomly allocated numbers 0 or 1.The first thread which runs first checks if the buffer is empty and a flag is set to the value of the thread,the next thread which comes enters the buffer only if its value is equal to flag and a variable called count is incremented indicating the number of elements in the buffer.The threads whose value is not equal to the flag or the threads which run after the buffer is full are enqued into a queue.When the buffer is full,the numbers in the buffer are cleared completely and the first thead in the queue's value is set as the flag and the process continues.

3)

First shmat and shmget functions are used to share the memory occupied by the buffer. Then in the merge function 2 children are created recursively which take left and right half's as input and merge them,the parent is made to wait till the childs are done and then it merges the left and right halfs recursively.In the merge function if the size of either the left or right arrays are greater than or equal to 5 then the arrays are sorted using selection sort and the numbers are sorted and merged to get the final sorted output.