0.8 Exercises

1. Let's suppose an arrival rate $\lambda = 50 messages/sec$ and a service rate $\mu = 50 messages/sec$. Given the message arrivals in the table bellow and a size of $100 bytes$ per message, which is the minimum buffer size needed to guarantee that no message is lost?

Time	1	2	3	4	5	6	7	8	9	10
#Messages	2	10	100	50	20	75	150	100	40	10

2. Let's suppose a stationary situation in the processing of a stream, where the whole memory available is occupied by messages. Assume also the existence of a separated buffer big enough to allow us the complete processing of these messages already in memory without being concerned with new arrivals. Assume we have $M = 10$ memory pages with $R_S = 10$ messages per page. If the processing of these messages consists only of a lookup and in-memory processing/comparison of a message and a tuple is thousand times smaller than a disk access, give the cost in these two situations considering that every disk block of the table contains also $R_T = 10$ tuples:

   a) Going through an index for each message with cost $h = 3$ for the index and one more disk access to the lookup table per message.

   b) Bringing each block of the lookup table (whose size is $B = 100$) into memory and checking all messages in memory against all its tuples.

3. Let's suppose that setting the execution environment for the processing of messages in a stream is $S = 100$ (e.g., placing&retrieving all the information to/from the stack). Both packing and unpacking the messages in a batch (i.e., a list of elements) have the same cost of $Pk = 1$ per message, and processing each message is $Ps = 10$.

   a) Which is the cost of truly streaming 10 messages one at a time?

   b) Which is the cost of processing one micro-batch of 10 messages?