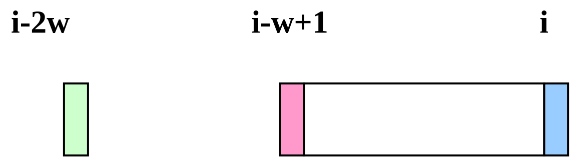
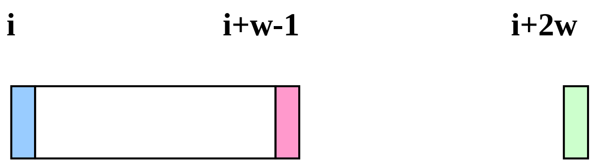
Course: **COMS W4119 Computer Network**
Term: **2006 spring**
Title: **Homework 3 solution**

1.

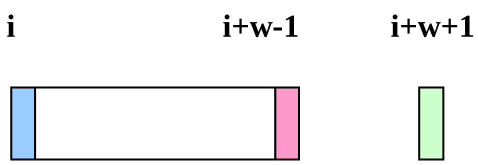
A. S = 2w , Receiver thinks i = i-2w ?
If the sender is sending packet (i). Because S = 2w, the lower boundary of sender's window must be (i-w+1), Receiver think packet(i) as packet(i-2w), but packet(i-2w) is not inside the possible sender's window, therefore it couldn't happen.



B. S = 2w , Receiver thinks i = i+2w ?
If the sender is sending packet (i). Because S = 2w, the upper boundary of sender's window must be (i+w-1), Receiver think packet(i) as packet(i+2w), but packet(i+2w) is not inside the possible sender's window, therefore it couldn't happen.

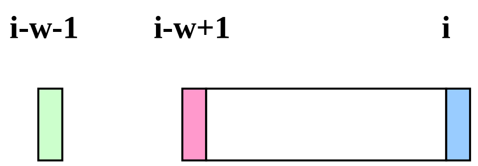


C. S = w+1 , Receiver thinks i=i+w+1?
If the sender is sending packet (i). Because S = w+1, the upper boundary of sender's window must be (i+w-1), Receiver think packet(i) as packet(i+w+1), but packet(i+w+1) is not inside the possible sender's window, therefore it couldn't happen.



D. S = w+1 , Receiver thinks i = i-w-1 ?
If the sender is sending packet (i). Because S = w+1, the lower boundary of

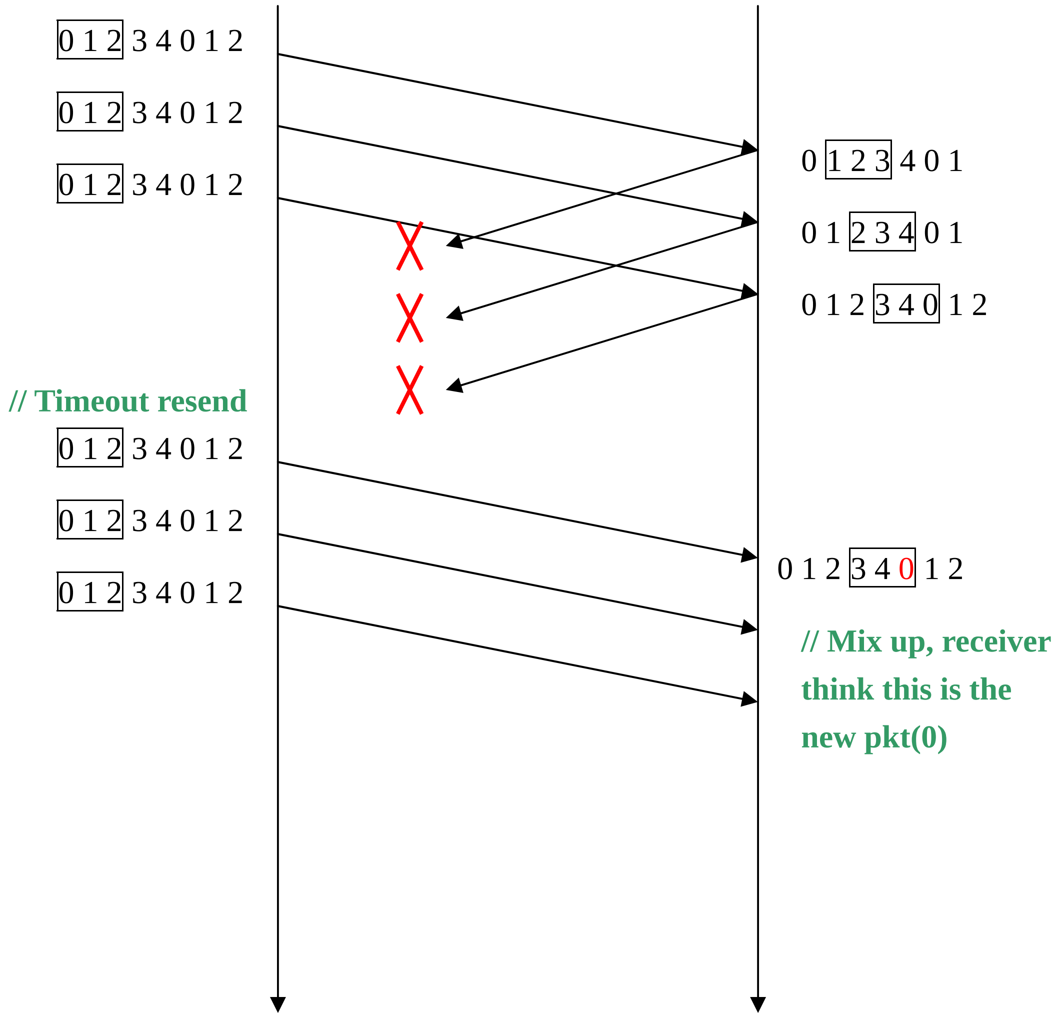
sender's window must be (i-w+1), Receiver think packet(i) as packet(i-w-1), but packet i-w-1) is not inside the possible sender's window, therefore it couldn't happen.



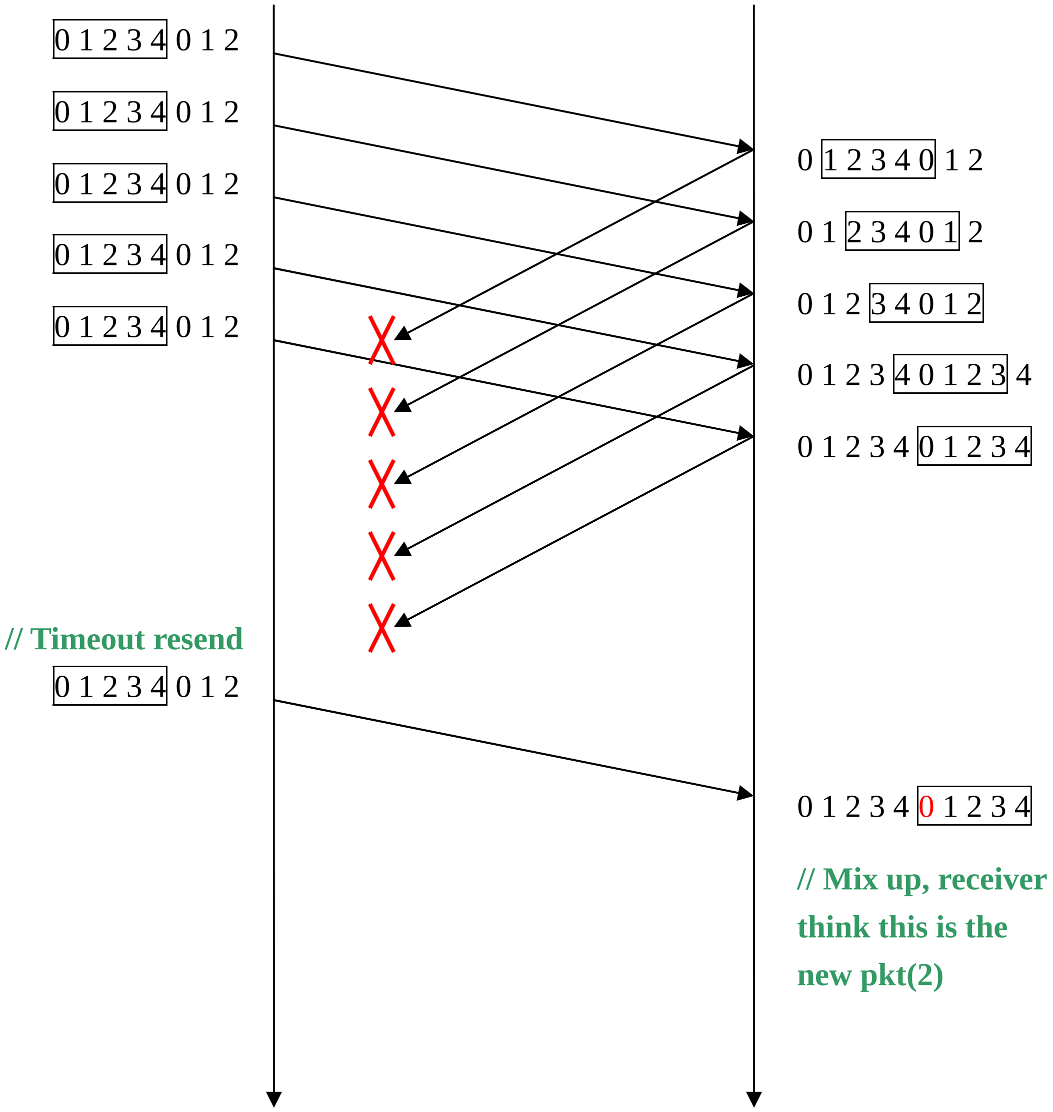
E. No matter S is increasing from 2w and w, the range of sender's window is still lies on [i-w+1, i+w-1], so that $S \geq 2w, S > w$ will hold for all cases.

2.

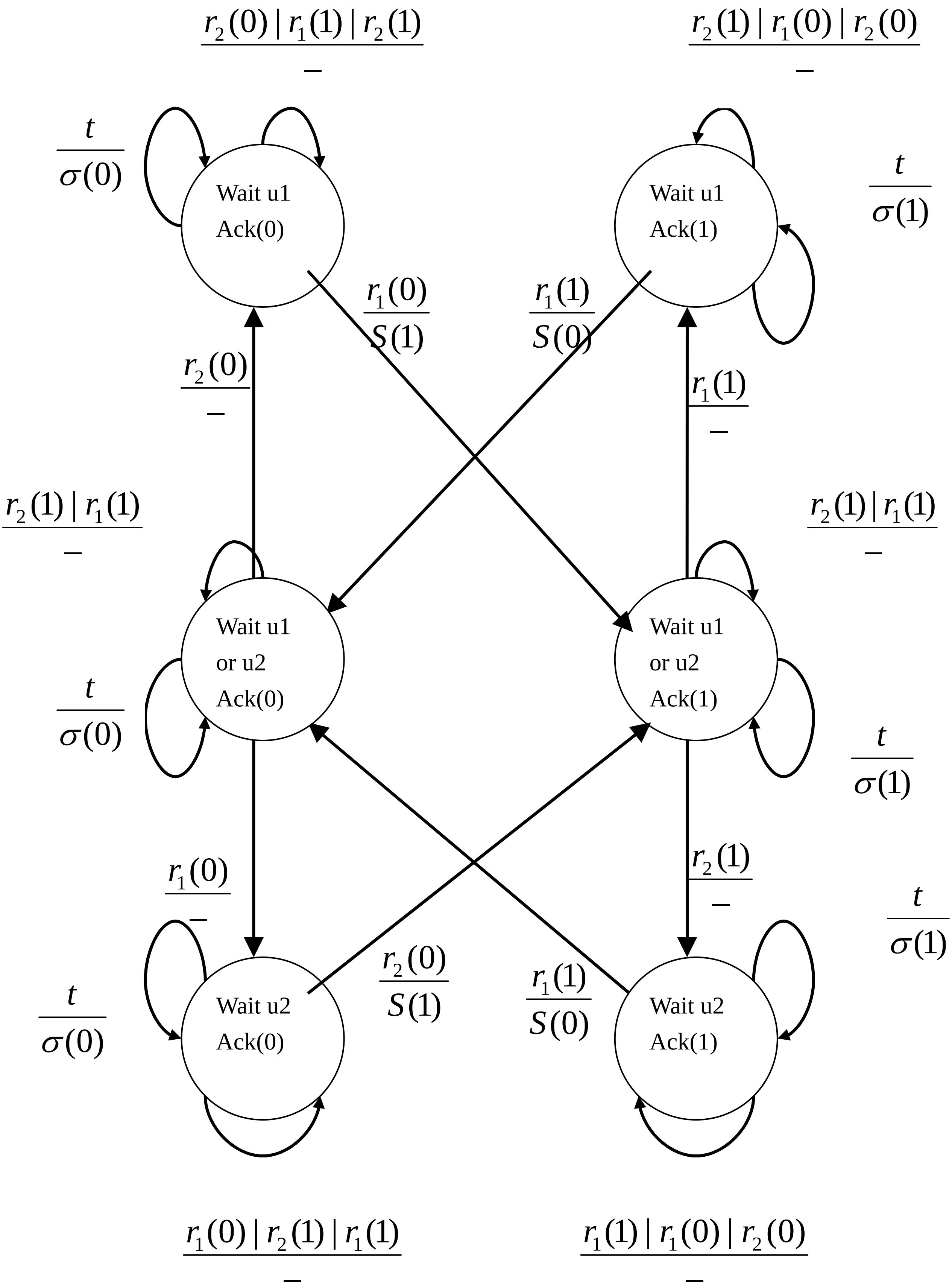
(a) SR, S = 5 , W = 3



(b) Go-Back-N, S = 5 , W = 5



3. FSM (T: timeout), there is more than one way to do this problem.



4.

A codeword of degree L has L data words XOR'd together, and can recover a codeword only if (L-1) of the data forming the codeword are already received (in the buffer) and one has not.

If L > k+1, then the probability is 0.

Otherwise,

$$P = \frac{(N-k)*(k, choose, L-1)}{(N, choose, L)}$$

$$= \frac{(N-k)*(N-L)!*L!*k!}{(k-L+1)!*(L-1)!*N!}$$

$$= \frac{(N-k)*(N-L)!*L*k!}{(k-L+1)!*N!}$$

where (x choose y) = x! / y!(x-y)! , L means the “l” letter in the document

5.

A. N is a random variable that equals the number of packets that need to be sent in order to receive k data packet.
And E[N] is the expected numbers of data plus repair packets that are sent to recover the k data packets.

$$E[N]= \sum_{i=k}^{\infty} i * p(N=i)$$

$$= \sum_{i=k}^{\infty} i * \binom{i-1}{k-1} * (1-p)^k * p^{i-k}$$

Where $\binom{i-1}{k-1}$= Choose k-1 from i-1 = $\frac{(i-1)!}{(k-1)!*(i-k-2)!}$

B.

If n<k, then

$$p(N \le n) = 0$$

If n>=k, then

$$p(N \le n) = \sum_{i=k}^{n} \binom{i-1}{k-1} * (1-p)^k * p^{i-k}$$

for each i, the assumption is that the last packet is received in the ith round. So you have that last (k th) arrived packet in the ith slot, and you have to "choose" where to put the remaining k-1 packets in the other i-1 slots.