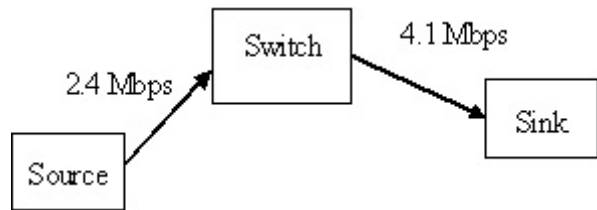


**ECEN4533 Exam #1 5 March 2009**

1) A proprietary cell switch has a 9 Mbps output line. Traffic on this line is statistically multiplexed. An average of 3,460 cells/sec are input to this switch. The IAT is known to be exponentially distributed. The fixed cell size is known to be 156 bytes.

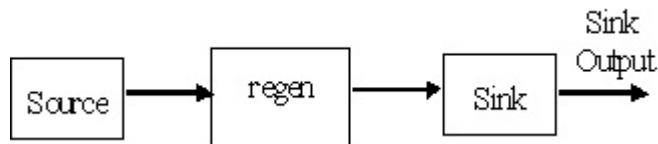
- 1a) [10] **Compute** the trunk load  $\rho$  on this system. [Answer = 0.4798]  
 1b) [15] **Compute** the average number of cells in the switch queue. [0.2213]

2) A 34 MB file is to be transmitted over a 2 hop system shown. The file is to be broken into segments of maximum size P bytes, and 50 bytes of overhead will be added to each segment, yielding P+50 byte packets for transmission. Assume packets can be transmitted back-to-back, and that no other traffic is on the system for the duration of this file transfer. The propagation delay for this problem is so small it can be ignored.



- 2a) [10] **Write an equation** that expresses the time it takes to transfer this entire file. Time starts when the leading edge of the 1st packet is injected into the 1st link, and stops when the trailing edge of the last packet arrives at the sink. [Time = (P+50 bytes/packet)(8 bits/byte)(34\*10<sup>6</sup>/P packets)/(2.4 Mbps) + (P+50 bytes/packet)(8 bits/byte)/(4.1 Mbps)]  
 2b) [15] **Determine** the segment size P that will minimize this file delivery time. [53,892 bytes]

3) A binary digital Wide Area Network link is shown to the right. This system has a regenerative repeater (regen) at mid-span, and a bit detector at the system sink. The regen cleans up and re-times its input. Suppose that both the regen and the sink bit detector both have 10% bit error rates. 90% of the time if a logic 1 (or 0) is received, they will output the correct bit. 10% of the time if a logic 1 (or 0) is received, a 0 (or 1) will be output incorrectly.



[15] **Compute** the P(the sink correctly outputs the proper bit that was input). Note that if both the regen and sink bit detector make errors on the same bit, it will be correctly output. [0.82]

4) An application generates messages of two sizes; 333 bytes (40% of the time) and 3,610 bytes (60% of the time). These messages are passed down to TCP, which has a maximum segment size of 1,460 bytes, then on to the IPv4 and Ethernet layers. Total TCP, IP, and Ethernet overhead is 66 bytes. Hence the *maximum* transmitted packet size is 1,526 bytes.

[10] **Compute** the *average* packet size that would be moved over this network. [1,111 bytes]

5) The traffic matrix shown below indicates the peak amount of traffic, in Mbps, that must be

moved between 4 departments on a college campus. It has been decided to construct a wired LAN backbone network in a ring configuration as shown. *All traffic is to be routed over the ring in a clockwise direction.*

[25] **Determine the amount of traffic** that must be moved over the 4 links shown. [234.2 clockwise on all links.]

From \ To	Education	Math	Engineering	Admin
Education	-	8.8	1.9	86.2
Math	8.8	-	6.9	86.7
Engineering	1.9	6.9	-	43.7
Admin	86.2	86.7	43.7	

