INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR
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Spring Semester: 2015 Department: CSE
Sub. No: CS CS31006 Sub. Name: Computer Networks

Answer as much as you can

Answers

Q.6

(a) With G = 2 Poisson's Law gives a probability of e^{-2}.
(b) $(1 - e^{-G})^k e^{-G} = 0.135$ Å~ 0.865^k .
(c) The expected number of transmissions is $e^G = 7.4$.

(b). The CRC checksum polynomial is or degree 32, so (a) Yes. CRC catches all single-bit errors.
(b) Yes. CRC catches all double-bit errors for any reasonably long message.
(c) No. CRC may not be able catch all even number of isolated bit errors.
(d) Yes. CRC catches all odd number of isolated bit errors.
(e) Yes. CRC catches all burst errors with burst lengths less than or equal to 32.
(f) No. CRC may not be able to catch a burst error with burst length greater than 32.

Q5.

(a). In N, since the maximum delay is 10 seconds, an appropriate buffer can be chosen to store a little more than 10 seconds of data at destination D. This will ensure that there will be no jitter experienced. On the other hand, in N 2, a smaller buffer, perhaps 2-3 seconds will be used, but some frames (that experience larger delays) will be dropped.

(b) (i). Sending 1000 bits over a 1 Gbps line takes 1 μsec. The speed of light in fiber optics is 200 km/msec, so it takes 0.5 msec for the request to arrive and another 0.5 msec for the reply to get back. In all, 1000 bits have been transmitted in 1 msec. This is equivalent to 1 megabit/sec, or 1/10 of 1% efficiency.
(ii). At 1 Gbps, the response time is determined by the speed of light. The best that can be achieved is 1 msec. At 1 Mbps, it takes about 1 msec to pump out the 1024 bits, 0.5 msec for the last one to get to the server, and 0.5 msec for the reply to get back in the best case. The best possible RPC time is then 2 msec. The conclusion is that improving the line speed by a factor of 1000 only wins a factor of two in performance. Unless the gigabit line is amazingly cheap, it is probably not worth having for this application.

(c). The first bursts contain 2K, 4K, 8K, and 16K bytes, respectively. The next one is 24 KB and occurs after 40 msec.
(d). The next transmission will be 1 maximum segment size. Then 2, 4, and 8. So after four successes, it will be 8 KB.

(e). The successive estimates are 29.6, 29.84, 29.256.

33.

Q3.
(a). With a token every 5 μsec, 200,000 cells/sec can be sent. Each packet holds 48 data bytes or 384 bits. The net data rate is then 76.8 Mbps.

(b). The naive answer says that at 6 Mbps it takes 4/3 sec to drain an 8 megabit bucket. However, this answer is wrong, because during that interval, more tokens arrive. The correct answer can be obtained by using the formula $S = C/(M - \rho)$. Substituting, we get $S = 8/(6 - 1)$ or 1.6 sec.

(c). The address is 194.47.21.130.

(d). The mask is 20 bits long, so the network part is 20 bits. The remaining 12 bits are for the host, so 4096 host addresses exist.

(e). The initial IP datagram will be fragmented into two IP datagrams at I1. No other fragmentation will occur.
Link A-R1:
Length = 940; ID = x; DF = 0; MF = 0; Offset = 0
Link R1-R2:
(1) Length = 500; ID = x; DF = 0; MF = 1; Offset = 0
(2) Length = 460; ID = x; DF = 0; MF = 0; Offset = 60
Link R2-B:
(1) Length = 500; ID = x; DF = 0; MF = 1; Offset = 0
(2) Length = 460; ID = x; DF = 0; MF = 0; Offset = 60

Q2
(a). The minimum occurs at 15 clusters, each with 16 regions, each region having 20 routers, or one of the equivalent forms, e.g., 20 clusters of 16 regions of 15 routers. In all cases the table size is 15 + 16 + 20 = 51.

(b). Each packet emitted by the source host makes either 1, 2, or 3 hops. The probability that it makes one hop is p. The probability that it makes two hops is $p(1 - p)$. The probability that it makes 3 hops is $(1 - p)2$. The mean path length a packet can expect to travel is then the weighted sum of these three probabilities, or $p2 - 3p + 3$. Notice that for $p = 0$ the mean is 3 hops and for $p = 1$ the mean is 1 hop. With $0 < p < 1$, multiple transmissions may be needed. The mean number of transmissions can be found by realizing that the probability of a successful transmission all the way is $(1 - p)2$, which we will call α. The expected number of transmissions is just

$\alpha + 2\alpha(1 - \alpha) + 3\alpha(1 - \alpha)2 + \ldots =$

α

1 □□ =

$(1 - p)2$

□□□□1□□□□

Finally, the total hops used is just $(p2 - 3p + 3)/(1 - p)2$.

(c). To start with, all the requests are rounded up to a power of two. The starting address, ending address, and mask are as follows: A: 198.16.0.0 – 198.16.15.255 written as 198.16.0.0/20 B: 198.16.16.0 – 198.23.15.255 written as 198.16.16.0/21 C: 198.16.32.0 – 198.47.15.255 written as 198.16.32.0/20 D: 198.16.64.0 – 198.95.15.255 written as 198.16.64.0/19