CN2011 Midterm Solutions
Give an example of a stateless application layer protocol.

Ans: e.g., HTTP
1. (b) (10%) 

- Suppose a web server has 800 ongoing TCP connections. How many server-side sockets are used? How many server-side port numbers are used?

Briefly (two sentences at most each) explain your answer.
1. (b) (10%) 

- Ans: If there are 800 ongoing connections, and nothing else happening on the server, there will **801 sockets** in use – the single welcoming socket and the 800 sockets in use for server–to–client communication. The ONLY server–side port number in use at the server will be the **single port number** associated with the welcoming socket, e.g., port 80 on a web server).

- 數字各2分 解釋各3分
Give two examples of application layer protocols and their port numbers

Ans: HTTP 80, SMTP: 25, Telnet: 23 ...
2. (15%)

Consider sending a large file of $F$ bits from host A to host B. A and B are connected by path of $l$ links, and the links are uncongested (that is, no queuing delays). Host A cuts the file into segments of $S$ bits each (we assume here that $F$ is a multiple of $S$) and adds $h$ bits of header to each segment, forming packets of $S + h$ bits. Each link has a transmission rate of $R$ bps. Find the value of $S$ that minimizes the delay of moving the file from host A to host B. Neglect propagation delay.
Ans: The delay is \( \frac{S+h}{R} \times (\frac{F}{S} + l - 1) \) (10%)

Taking the derivative of the above equation and setting it to 0, we get \((l-1) - \frac{F \cdot h}{S^2}\)
so, \(S = \sqrt{\frac{F \cdot h}{(l-1)}}\) (5%)
4.(a) (5%)

- According to “The Design Philosophy of the DARPA Internet Protocols

- Which technique for multiplexing did DARPA choose (circuit-switching or packet-switching or others)? Why?
4.(a) (5%)

ANS:

- packet-switching (2%)
- Explain about services and networks (3%)
There are some goals with priority for the internet architecture in the paper. If we want to apply the goals to the internet today, should we change the priority of those goals? Explain why or why not.

ANS: Yes, (explain)
Suppose $k$ packets arrive simultaneously to a link at which no packets are currently being transmitted or queued. Each packet is of length $S$ and the link has transmission rate $T$. What is the average queuing delay for the $k$ packets?

ANS: $\frac{S(k-1)}{2T}$
Suppose within your Web browser you click on a link to obtain a Web page. The IP address for the associated URL is not cached in your local host, so a DNS lookup is necessary to obtain the IP address. Suppose that k DNS servers are visited before your host receives the IP address from DNS; the successive visits incur an Round-Trip Time of $T_1, T_2, \ldots, T_k$. 

7.(5%)
Further suppose that the Web page associated with the link contains three objects, consisting of one HTML text object and two small images on the same server. Let $T_0$ denote the Round-Trip Time between the local host and the server containing the objects. Assuming zero transmission time of the objects. Also assuming the connection is non-persistent and non-parallel. How much time elapses from when the client clicks on the link until the client receives all the objects?
ANS:

\[ T_1 + T_2 + \ldots + T_k + 6T_0 \]