1. (10 points) Suppose a TCP machine is sending full windows of 65,535 bytes over a 155Mbps channel that has a 12-msec one-way delay. What is the maximum throughput achievable? What is the line efficiency?

2. (10 points) Consider you are designing an e-banking transaction processing for an e-banking client host and a bank's centralized server. Suppose the system requires the response time is no more than 3 seconds, i.e. from the time instant the client sends out a request message of length $L_{request}$ to the server until the time instant the client receives the reply message from the server of length $L_{response}$. Assume both forward and return traffic will take the same route. The length of the route is K hops and the link capacity is B_i, i=1, ...K, for all links. Let d^i_{proc}, d^i_{queue}, d^i_{trans} and d^i_{prop} denote the per-hop communication processing delay, queueing delay, transmission delay and propagation delay. What is the response time? Assume the server processing time is d_{server}.

3. (10 points) In IPv4 protocol, there is field called TTL (Time to Live). What is the function of it? The use of TTL can help resolving the looping problem in packet routing. Why?

4. (20 points) About DNS (Domain Name Service)
   (a). What services are provided in a typical domain name system? Briefly describe each of them.
   (b). What are root DNS server and authoritative DNS server?
   (c). From an enterprise's perspective, why DNS server is important?

5. (30 points) Answer the following questions with respect to the given relational schema where the primary keys are underlined.

   EMPLOYEE

Employee_ID	Name	Address	Phone	Supervisor_ID	Department_ID

   DEPARTMENT

Department_ID	Department_Name	Manager_ID

   PROJECT

Project_ID	Project_Name	Department_ID

   WORKS_ON

Employee_ID	Project_ID	Hours

   (a). (5 points) Write an SQL to find the employees who live in Taipei city.
   (b). (5 points) Write an SQL to find all the projects controlled by the finance department.
   (c). (5 points) Write an SQL to find the employees who work on at least 3 projects.
   (d). (5 points) Write an SQL to find the employees who work on all the projects controlled by the marketing department.
   (e). (10 points) Is it possible to write an SQL to find all the subordinates of John Smith? Why/why not?

6. (20 points) Answer the following questions with respect to the normalization for relational databases.
   (a). (5 points) What is the normalization in relational database management systems?
   (b). (5 points) What is the third normal form (3NF)?
   (c). (5 points) What is the Boyce-Codd normal form (BCNF)?
   (d). (5 points) What is the major difference between 3NF and BCNF?