1. (10 points) In the sliding window protocol, to ensure correct operations, what is the maximum window size should be in terms of the range of the sequence number. Why?

2. (10 points) Why does UDP exist? Would it not have been enough to just let user processes send raw IP packets?

3. (20 points) Congestion control has been one of the most important issues in Internet.
   (a). What conditions may cause network congestion?
   (b). Give at least two strategies that may prevent and/or control congestion?
   (c). Compare the advantage and disadvantage of the two strategies you give.

4. (10 points) In TCP, it implements the window advertisement by the receiver mechanism. Explain the design goals of it.

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

STUDENT

STUDENT_ID	STUDENT_NAME	ADDRESS	PHONE	DEPARTMENT_ID

DEPARTMENT

DEPARTMENT_ID	DEPARTMENT_NAME	CHAIRPERSON

COURSE

COURSE_ID	COURSE_NAME	ISBN	DEPARTMENT_ID

ENROLL

STUDENT_ID	COURSE_ID	GRADE

TEXTBOOK

ISBN	BOOK_TITLE	PUBLISHER	AUTHOR

   (a) Write a relational algebra to find the names of students who enroll more than six courses.
   (b) Write a relational algebra to find the names of straight A students.
   (c) Write an SQL to find the number of students in IM department.
   (d) Write an SQL to find the names of students who live in Taipei city.
   (e) Write an SQL to find the names of departments whose courses' textbooks are all published by 'AW publishing'.
   (f) Write an SQL to find the names of students who enroll more than five courses and whose textbooks are all published by the same publisher.

6. (20%) Of the following schedules,
   (1) $w_1(x), w_1(z), w_2(y), r_2(x), r_3(y), w_3(z), c_1, c_2, c_3$
   (2) $w_2(x), w_2(y), c_2, r_1(x), c_1, r_3(y), w_3(z), c_3$
   (3) $r_2(x), w_3(z), w_2(y), r_2(z), c_2, w_1(x), r_1(y), w_3(x), c_3, c_1$
   (4) $r_1(x), r_2(y), w_1(z), c_1, w_2(y), w_3(x), r_3(z), c_2, c_3$
   (5) $r_1(x), r_2(y), w_2(x), w_3(y), w_3(z), r_1(z), c_2, c_3, c_1$

   (a) which of them are serial?
   (b) which of them are recoverable?
   (c) which of them are avoid cascading rollback?
   (d) which of them are serializable? Show one of the equivalent serial schedules if it is.