

# ITS 413 – ASSIGNMENT 2

First name: \_\_\_\_\_ Last name: \_\_\_\_\_

ID: \_\_\_\_\_

Total Marks: \_\_\_\_\_

out of 70

Due Date: Friday 16 February 2007, 9am (you can hand in before the start of the lecture)

*I certify that, unless otherwise acknowledged, all work carried out in this assignment is my own.*

Sign Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Guidelines

1. This is an individual assignment. You are not allowed to work with other students, including checking your answers and providing help (if someone wants help, they should ask me!).
2. The assignment must be typed on a computer. It should be handed in on A4 sheets with a single staple in the top left corner. No plastic sleeves etc.
3. You must attach this Cover Sheet (including name, ID and signature) to the front of your assignment.
4. I only accept hardcopies of the assignment – that is, I will not accept an emailed copy of assignment.
5. Show all your working out and calculations. If you get the answer wrong, you may still receive marks for your calculations. If you only provide an answer (and no calculations), then you will be penalised.
6. State and explain any assumptions that you make.
7. When you are asked to discuss or explain something, then it is important that your explanation is very clear to the reader (me). Ambiguous or unclear explanations may receive 0 marks.
8. There are many resources on the Internet. You should of course make use of them, but do not restrict your study to just one resource (e.g. Wikipedia). You should use multiple sources, and acknowledge all sources in your references. Also make sure you write in your own words and draw your own diagrams.

## Question 1 [20 marks]

Write pseudo-code that describes the implementation of the sender's congestion control algorithm for TCP described in RFC2581.

You must define all parameters that you use. You can make assumptions, but you should explain or at least make a comment that an assumption has been made. For example, RFC2581 allows you to use different approaches to implement the algorithm – make sure you indicate which approach you have chosen.

Hint1: It is common to structure a protocol implementation in the following way:

```
while(1)
    if EventA then
        if ConditionA then
            ActionA
        else if ConditionB then
            ActionB
    else if Event B then
        Action C
```

```
        end if
    end while
```

You should use a similar structure.

Hint2: The events you need to consider are:

1. Receive an expected ACK
2. Retransmission Timeout
3. Receive 3<sup>rd</sup> Duplicate ACK
4. Receive ACK for Retransmitted Packet

In practice, there may be other events (such as Receive 4<sup>th</sup> Duplicate ACK) – for simplicity, you can ignore these special cases.

Hint3: You only need to show how the congestion control parameters change. You can ignore actions such as setting timers and sending packets.

Hint4: Section 3 of RFC2581 contains the main details of the algorithm.

## Question 2 [30 marks]

- a) Complete the design of the Gnutella peer-to-peer protocol.

The lecture notes provide an informal (and incomplete) description of the Gnutella protocol, including the 5 message types and some of the operations. You must provide a complete design of the protocol. You should follow the 5 components of a protocol. For the protocol rules, I suggest you use pseudo-code (see Question 1 for example) or state tables (a state-machine could also be used, but may not be the easiest approach!).

You do not need to define all fields in the messages, nor their sizes. But you should at least list the most important fields that are needed to make the protocol work.

You can assume there are no firewalls, and ignore the Push message (and any related functionality).

Note that as the protocol description in the lecture notes is incomplete, you will need to choose how to design the remaining parts of the protocol. You should explain why you make certain design decisions.

- b) The network on the last page shows the connections for a Gnutella network (e.g. the Ping/Pong have completed, and  $C=3$ ). Assume node 1 issues a search for a file stored on node 17. Nodes do not use a cache of search results. Once the query reaches node 17, it will give a unidirectional response along the same path the query arrived on. You can assume that each transmission takes the same time,  $t_h$ . Use your protocol design to answer the following:
- i. What is the number of messages sent using the Gnutella protocol?
  - ii. How long does it take for node 1 to receive the first response?
  - iii. Answer parts (i) and (ii), but assuming the file is stored on node 20, not node 17.
  - iv. Answer parts (i) and (ii), but assuming the file is stored on both node 17 and node 20.
- c) Part (a) uses the basic Gnutella protocol. Explain how the expanding ring search and random walker algorithms work for Gnutella, and then compare all three algorithms. You should use the figure on the next page to illustrate how the two algorithms work. (You may make copies of the figure, or download the Visio or Word file).

**Question 3** [20 marks]

Suggest ways in which the SIIT website can be optimised for search engines. You should divide your methods into “good” and “bad” – where the “bad” methods are those that use questionable (either ethically or legally) techniques. You should explain why you think these methods may be questionable. You can focus on the following pages of the SIIT website (but may give recommendations applicable to the entire site):

- <http://www.siit.tu.ac.th/indexs.html>
- <http://www.siit.tu.ac.th/overview/intro.html>
- <http://www.siit.tu.ac.th/program/undergrad.html>

Hint: You should try to describe the methods to enough detail such they could be presented to the Web site committee in the SIIT Computer Centre.

Note that SIIT website usually comes up first when searching for SIIT on Google, however on search for more generic phrases (e.g. “international technology university Thailand” and similar) it does not rank as well.

Marking: This question will be marked based on the accuracy/appropriateness of the methods suggested, as well as the number of methods and a clear description of what the Computer Centre should do to implement it. Also, I will rank the answers from all students – for example, the best answers will be given the most marks, while others will be marked relative to this.

*Gnutella network for Question 2*

