TR2202

NATIONAL UNIVERSITY OF SINGAPORE

EXAMINATION FOR THE DEGREE OF BACHELORS WITH
A MINOR IN TECHNOPRENEURSHIP
(Semester I : 2002-03)

TR2202 – TECHNOLOGICAL INNOVATION

November 2002 – Time Allowed: 2 Hours

INSTRUCTIONS TO CANDIDATES

1. This examination paper contains **THREE (3) Questions**. You must answer **TWO QUESTIONS.**

2. Question **ONE** is **COMPULSORY**. You must answer it, along with **EITHER** Question TWO **OR** Question THREE.

3. The total score for this examination is 100 marks, of which Question 1 comprises 60 marks.

4. You will be rewarded for writing answers that are <u>thoughtful, creative and concise</u>.

5. This is an open book examination. Students are allowed to bring in any books and any amount of notes.

Question 1: COMPULSORY (60 Marks)

IMPORTANT: YOU MUST ANSWER QUESTION ONE.
IT CONSISTS OF THREE PARTS. EACH PART IS WORTH 20 MARKS.

Question 1a (20 marks)
You are currently considering whether to start a high-technology company. The firm will enter a market in which intellectual property protection is weak and complementary assets are tightly held by established firms. Under what circumstances would it be worthwhile for you to enter such a market? What would be your strategy for competing/cooperating with the established firms?

Question 1b (20 marks)
According to Christensen, a disruptive technology is one that starts off with inferior technical performance but eventually becomes good enough to take over the market. Would you consider NEWater to be a disruptive technology? What are the implications for firms competing in the water-processing industry?

> Background: NEWater is used water that has undergone a stringent purification and treatment process using advanced dual-membrane (microfiltration and reverse osmosis) and ultraviolet technologies. NEWater exceeds the World Health Organisation drinking water standards. It is even suitable for wafer fabrication plants, which require very pure water. In fact, NEWater has such a low mineral content that it is tasteless. For domestic use, NEWater is mixed with normal reservoir water to "put" some minerals back in. This is done simply to give it a more appealing taste. By year 2012, Singapore plans to obtain 15% of its water from NEWater, 5% from sea water desalination and 5% from industrial water.
> Source: http://www.visionengineer.com/ and http://www.pub.gov.sg/

Question 1c (20 marks)
Clark and Wheelwright describe four kinds of organizational structures for managing product development teams: functional, lightweight, heavyweight and autonomous. Which of these would you use to organize a joint-venture project between your firm and another company? Discuss your reasons.

--- END OF QUESTION 1 ---

Question 2: (40 Marks)

IF YOU ANSWER QUESTION 2, DO NOT ANSWER QUESTION 3.

Microsoft Office is a well-known productivity software suite containing a word processor, spreadsheet, database, presentation software and email client. Many people would argue that it has achieved consumer 'lock-in' for a variety of reasons, including the data format used, familiar user-interface and Microsoft's brand name. It also exploits complementary technologies such as the Microsoft Exchange Server, which can easily synchronize the address book and contact information on an individual user's computer running Microsoft Outlook. This is useful for large corporations, government departments and universities.

Recently an alternative office suite has emerged to challenge Microsoft Office. Named Staroffice, it was developed by a small German startup company that eventually was bought out by Sun Microsystems, which is a major manufacturer of computer workstations and servers. Staroffice is becoming popular due to its low price (originally free but now US76, as compared to US479 for Microsoft Office Standard Edition). Staroffice can be used to open and edit documents created using Microsoft Office; this capability is described by prominent software reviewers as "perhaps flawless for around 90% of Microsoft Office documents" and "especially good for simple documents".

Staroffice is <u>partially</u> based on an 'open source' approach to software development. A large fraction of the actual software code is made public and can be freely downloaded. This public component is known as "OpenOffice.org". By making its intellectual property public, Sun is hoping to attract independent software developers and other companies to participate in building the Staroffice platform.

Unfortunately a problem arises because some programmers feel that they are being exploited by Sun. Under the Openoffice licensing terms, developers <u>must</u> make their changes and improvements to the software available to Sun. In addition, developers are required to transfer the copyright for their work in writing to Sun. Some external developers have expressed a lack of interest to work under these terms.

Suppose you are the manager at SUN in charge of the Openoffice Project. What would you do to compete against Microsoft Office? What are the issues you are likely to face from the rest of the corporation, and how would you overcome them? How would you entice external programmers to help develop your software?

Question 3 (40 Marks)

IF YOU ANSWER QUESTION 3, DO NOT ANSWER QUESTION 2.

Emily, Wai Fan and Rashid are undergraduate students at NUS. Last year, they worked jointly with Professor Jaya on a research project to <u>develop a new communications technology</u> for implantable chips. These are semiconductor chips similar to smart cards, but very tiny. Around the size of a grain of rice, they can be embedded below the skin surface of a person or animal. Various applications have been dreamed up, including using it as an identification device, as a way to find lost children and pets, as a medical storage device to be used in the event of an emergency, and as a virtual wallet. However, the technology is very new and only recently given preliminary FDA approval in the USA.

The NUS team's innovation was to develop a new way for implantable chips to 'speak' directly with any bluetooth-enabled device such as a handphone or PDA. Prior to this, implantable chips required specialized equipment to extract the data in them. The NUS innovation consists of some hardware that the team developed, along with special software to communicate using the bluetooth standard. The team is currently filing for patents in USA and Singapore through the NUS INTRO office, which has agreed to pay for the patent and split 50% of the profits with the inventors.

As the unofficial leader among the students, Emily is anxious to start a business based on their exciting invention. She is unsure whether to launch a company with her team or license the technology to a medical device company like Becton Dickinson, which has a strong presence in Singapore. None of the team members have much money except Prof Jaya. However, Emily thinks it might be possible to get some seed funding from a VC she met at an innovation seminar.

Another issue is that the rest of her team is not as ready as she is to start a business. Wai Fan is on a scholarship which has a 4-year bond and Rashid has reservations about the technology. He worries that it might be abused to invade the privacy of individuals and doesn't want to get caught up in a long battle for regulatory approval. As for Prof Jaya, for some strange reason he seems more interested in publishing papers than commercialising the technology.

How should Emily proceed?

- END OF PAPER -