

**BOWIE STATE UNIVERSITY  
COMPREHENSIVE EXAMINATION FOR  
MANAGEMENT INFORMATION SYSTEMS  
19 March 2005**

**Instructions:**

The Comprehensive Examination for Management Information Systems is a three hour examination. You are required to answer **three questions**. You must respond to one question from Part A (the technical portion of the curriculum) and one question from part B (the management-related portion of the curriculum). Finally, respond to a third question from either part A or part B.

Grading the comprehensive exam requires approximately six weeks. No results will be released until all examinations, in all degree programs, have been graded. Answers to each question are graded "blind" by three faculty members with expertise in the subject matter.

Answers are graded as either "pass" or "fail." "Pass" indicates a minimum grade of B. In the event of a "fail" on the exam written comments from the graders explaining why the student's response was insufficient and what would be required for a passing grade will be supplied to the student. A student must pass two of three questions to receive a grade of "pass" for the comprehensive examination.

A set of URL's previously provided describe the general scenario, described in summary below. While the URL's provide additional background to the scenario, the summary below provides sufficient background for good responses to the comprehensive examination questions

**General Scenario:**

On 1 January 2005 Germany's satellite-based truck toll system began operation. Delayed from the originally-planned start-date of 31 August 2003 initial reports (as of 4 January) are that the system is working well, although only about one-third of the trucks on the autobahns have been fitted with the on-board tracking devices. (Drivers of the other trucks must use special terminals located at gas stations and truck stops to "buy" their planned routes in advance.) The on-board unit uses the US global positioning satellite (GPS) to keep track of where the truck is, and at regular intervals sends messages to a calculation center, which collects the data so that the vehicle owners can be invoiced for the toll owed. There are control bridges in place along the autobahns to recognize trucks and, if not receiving a signal from an on-board unit, photograph the truck's license plate.

The toll system was originally planned to go into operation August 2003. The consortium of companies developing it did not manage to meet that deadline. The system has gone into operation as of 1 January 2005 with "phase 1" on-board tracking devices, and it is anticipated that these will be replaced by 1 January 2006 with "phase 2" devices which have additional capabilities such as being able to communicate with the vehicle owner's bank to automatically pay the toll.

The links provided gave approximately 20 pages of background information on how the system works, and on some of the problems that have occurred during its development. As you answer the questions on the comprehensive exam, please remember that the scoring of your response will be based on how well you can *apply* what you have learned to specific questions, some of

which invite reasonable speculation that outsiders cannot know as fact about the toll system and its development. The information provided in this introduction, and within the questions themselves, should be sufficient to allow you to demonstrate your knowledge and your ability to apply it to what is asked, whether or not you have read the background material on the toll system.

### **Comprehensive Examination Questions:**

#### **Part A**

(answer at least one question from Part A)

1. Approximately 800,000 trucks are expected to use the system each day. Each truck's on-board tracking device sends its information to the "calculation center" every 100 kilometers traveled by the truck.
  - (a) Explain whether the "calculation center" is more likely to be a distributed system or one very large mainframe.
  - (b) Explain how the receiving system(s) could be either interrupt-driven, or function through polling. Which would you recommend, and why?
  - (c) Assuming that each transmission from the on-board device contains date, time, ID, kilometers traveled since last transmission, and location information, explain whether data compression is needed within the overall system and, if so, whether it would more likely be performed by the on-board device or somewhere else in the system.
  
2.
  - (a) Assuming that the programming of the "phase 1" onboard devices was done using an object-oriented programming language, should "phase 2" be accomplished with the same language? What features of an object oriented language would justify such?
  - (b) Languages used within the overall system should accommodate the interface with the global positioning system, the database system, and the electronic funds transfer system. For each of these functions identify an appropriate programming language and explain why it is appropriate.
  - (c) Speculate convincingly on three types of programming problems that could have contributed to the delays in the development of "phase 1" of the toll system.
  
3. Much of the data transmission within the toll system will be via wireless network systems.
  - (a) Discuss three important attributes of the information to be transmitted by the on-board devices, being sure to explain why each is important.
  - (b) Describe in convincing detail two data transmission needs within the toll system that may NOT need to be done wirelessly. Describe a network structure that will meet the needs of the system.
  - (c) Whatever the network transmission medium, wireless or not, accuracy and security of the data is crucial to the success of the system.
    - (1) Identify several vulnerabilities to the accuracy of the data that might exist.
    - (2) Describe three different error detection/correction methods, and explain the extent to which each can be expected to ensure accurate data.

## Part B

(answer at least one question from Part B)

4. The toll system was developed by Toll Collect, a joint venture of three companies. Assume that one of the companies (H - the hardware company) is providing the on-board devices and control bridges, the second company (N - the network company) is providing the access to satellite and other networking support, and the third company (S - the software company) is producing the software
  - (a) Discuss the advantages and disadvantages to both Toll Collect and the individual consortium companies of such a joint venture.
  - (b) There is much need for accountability on such a joint venture: accountability to the German government, accountability to Toll Collect, and accountability of each of the three firms involved to each other. How can each stakeholder in the completed system insure that the delivered system is meeting the requirements?
  
5. There was significant delay from what was originally planned as the starting date of the toll system. The original implementation date was to have been 31 August 2003, the system which came into operation at the beginning of 2005 is still not the final version – there will be a conversion to “phase 2” at the beginning of 2006.
  - (a) Obviously the delays in implementing “phase 1” were significant, even to the point that in February 2004 the German government threatened to cancel the contract. Based on your knowledge of systems analysis, design, and implementation, what could have caused such massive delays in this particular scenario?
  - (b) A question that must typically be answered when implementing/upgrading any system is whether the software needs to be developed from scratch or there is current off-the-shelf software (COTS) currently available that can be utilized. A major portion of “phase 2” is the automatic payment of tolls through the vehicle owner’s bank. There is software already available to accomplish electronic funds transfer. What questions need to be answered regarding incorporating COTS to accomplish the toll payments?
  
6. Obviously, the information supporting the toll system is being stored in one or more databases.
  - (a) Some aspects of the system must operate in real time. For example, when a truck approaches a control point without a valid on-board device ID, the system must determine in real time that the license plate must be photographed. In addition, the database(s) will be very large with roughly 800,000 trucks using the system daily. How can the database designers insure that the system can operate in real-time?
  - (b) What are three additional performance-related decisions that the database designers would have needed to make that would have major impact on the toll system? What would your recommendations be, and why?