EXAMINER'S REPORT

MAY 2001

LOGISTICS MANAGEMENT

General Comments

The results last year had only three "As" with the highest mark 76%. This year there was a big improvement with five "A"s and two over 80%. Overall 38% failed this year compared with 48% last year, and a quarter of these were eligible to pass by compensation. The case was done very well compared to last year while the quantitative questions were done moderately well. So, once again, I will focus on Sections C and D in this report.

The way this course and exam is structured requires one to really get into the theory, the techniques and how to apply the ideas in practice. This follows a learning cycle. Ideally people should look at the cases early on to get an idea of the types of problems which occur. These are mixtures of marketing, logistics, mathematics and strategy. Subsequently one should get into the theory, but not spend the year learning it off. Usually the theory was reasonably well done, although not as well this year despite the improvement in the text. Basically I expect a clear understanding of what is in the text and some practical illustrations from outside, such as from Irish applications. The middle part of the year should be spent on the quantitative techniques, linking them into the cases and the theory, and anecdotes about Irish companies where possible. This aspect has improved in recent years.

People can get through by focusing on one of the parts, but this year there were few instances of full marks for a question. Both students who scored over 80% got full marks on the case. Consequently, people who failed invariably did one of the sections very poorly and were not able to compensate from another section. It is safer to prepare all the sections. All except one of the failures had performed badly on the quantitative questions.

The case questions are geared towards bringing one through a process of analysis, evaluation, diagnosis and prognosis. This was quite well done, although more could have addressed some of the quantitative aspects in the case. Only one person got full marks on the theory section although most people specifically related to the question. There were fewer instances of people ignoring the question and writing all they know about logistics.

Quantitative questions

The idea of having two different quantitative sections is to separate the less standard from the standard, the unstructured from the straightforward application of algorithms. The **transport** question is an example of a standard application of an algorithm that many people got mainly right. Not as many as in the past found the shadow costs to test for optimality. For the first time I added an additional part to the question, asking for a "simple yet exact explanation of the consequences in terms of changed routing instructions and consequent increases in costs". This was not done well, suggesting that the understanding of the practical consequences of the solutions could be stronger. In this case I was looking for two things. Firstly, closing the Rosslare to France route means switching the routing out of Dublin and Rosslare and into France and Holland, causing a net increase of £4 per tonne delivered. Secondly, the aspect everyone missed was that, if those responsible for route planning had known in advance that there was going to be a protest at Le Havre, they would have directed the truckers away from Rosslare because of the expense of routing out of Rosslare to Holland and Germany.

The other such question in Section D was a standard application of **graphical linear programming** with sensitivity analysis. It seems to have not been fairly well prepared generally. It is not a simple method; one must develop an understanding of the technique. The basics are straightforward. 1. Develop the constraints. 2. Draw the graph. 3. Find the corners most likely to be best. 4. Put these into the objective function to get the best one. Generally this was done reasonably well, except that many solved only one point.

The best solution was to make 667 of each software package: Integrated Solver and Expert Maker giving a profit of £26,666.67. Calculating the shadow prices in Part (b) of the question was tricky because the numbers are so small. (i) An extra hour in Assembly produced £2.67p additional profit. (ii) An extra hour in Testing produced £0.89p additional profit. For Part (c) 6 hours assembly @ £2.67p marginal profit plus 10 hours testing @ £0.89p marginal profit give a marginal profit of £24.92 for the current combination of resources. The new product would give a unit profit of £20, which is lower than what is being achieved currently. Consequently do not use it. This part was done quite well although many people rounded their figures too soon.

Section C contained a **formulation** question. Only a few knew what to do. Even some who did the linear programming question well did this one badly. The key to this is the starting point. You must take an immensely practical point of view and say "what do we need to know here?". In this case it is the following: "I have three different commodities. How much of each of these do I put into the three holds?" What answer does the logistic expert deliver to the captain? Nine figures: the amount of Commodity A in the Forward Hold, the Centre Hold, and the Aft Hold; and the same for Commodities B and C.

You then use some language to express the relationships. I call the amount Commodity A in the Forward Hold AF, and so on for the others. The answer then is:
Profit: Maximise £10(AF + AC + AA) + £12(BF + BC + BA) + £8(CF + CC + CA)
subject to:
Weight limits in the Forward Hold: $AF + BF + CF \leq 2{,}000$ tonnes
Space limits in the Forward Hold: $60AF + 50BF + 25CF \leq 100{,}000$ cubic feet
Weight limits in the Centre Hold: $AF + BF + CF \leq 3{,}200$ tonnes
Space limits in the Centre Hold: $60AF + 50BF + 25CF \leq 140{,}000$ cubic feet

Weight limits in the Aft Hold: AF + BF + CF ≤ 1,900 tonnes
Space limits in the Aft Hold: 60AF + 50BF + 25CF ≤ 95,000 cubic feet
Limits of Commodity A available: AF + AC + AA ≤ 7,000 tonnes
Limits of Commodity B available: AF + AC + AA ≤ 6,500 tonnes
Limits of Commodity C available: AF + AC + AA ≤ 4,000 tonnes
The difficult constraint was the requirement that the weight in each hold must be proportional to its weight capacity. Again, the trick is to try and represent this in your mind as something you must convey to the captain. For example, if there was a problem in that the Forward and Centre Holds were full, and the Aft was 20% full, what would you say? "I want the same proportions in each hold." or alternatively, "If the ship sails 80% full I want it to be 80% full in each hold." If the captain says "Do you mean space?" you would say "No, I mean weight.". So, what should be the proportion in Holds A, B and C?

$$\frac{AF+BF+CF}{2{,}000}=\frac{AC+BC+CC}{3{,}200}=\frac{AA+BA+CA}{1{,}900}=\frac{Tonnnes\ in\ Hold}{Capacity\ of\ Hold}$$

Difficulties with questions such as this raise questions about what a graduate of the Marketing Institute should be able to do. On the one hand there are practitioners out there who are doing all this in practice, whether they are optimally loading container lorries for trips to the continent, or load balancing ships. On the other hand there is excellent computer software that can carry out any kind of simple calculation. One role for the Graduate should be to be able to marry the expertise of the past with the software capabilities of the future without always having to call for help.

The other Section C question was on **stock (inventory) control**. This is a long section in the text and likely to occur every year. I was very surprised that some people did not get the average demand of 5.9 (or 6) units and the economic order quantity of 19.8 (or 20) units. The re-order level question was also simple and short enough to do.

Re-order Level	Safety Stock	Annual Stock Holding Costs	Possible Shortages	Probability	Number of Orders Per annum	Shortage Cost (x £10)	Total Cost
5	**0**	**0**	**1** **2** **3**	**.3** **.2** **.1**	**15**	**£45** **£60** **£45**	**£150**
6	**0**	**0**	**1** **2**	**0.2** **0.1**	**15**	**£30** **£30**	**£60**
7	**1**	**£18**	**1**	**0.1**	**15**	**£15**	**£33**
8	**2**	**£36**	**0**				**£36**

The minimum cost of £33 indicates that the re-order level should be 7 units. Given that the average usage in one week is 6, this means a buffer stock of 1 unit.