

CREDIT GRANTED OR NOT?

A-lympiad - assignment

Final round, March 2002



or



Mathematics A-lympiad 2001/2002 final

- Read through the complete problem first.
- Use a time schedule: plan your time well.
- Start in time with writing the rapport (see 'Products').
- Start the preparation for your presentation not earlier than Saturday.
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- Don't forget to number the pages.
- Write the names of the team members, together with the name of your school, at the cover.

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Lots of fun and good luck!

Credit granted or not?

In a lot of shops it is possible to buy on credit. Both the customer and the store-owner profit from this system. That is, if everything goes as intended...

In this mathematics A-lympiad assignment you will develop a systematic procedure to decide quickly upon a customers' application form, whether or not this customer is creditworthy.

In order to design the system, you will first analyse data available from former credit applicants. Based on this you'll design the decision-making system. You then will test this system to see how well it performs, and finally you will propose improvements to your system.

Introduction

A large chain of department stores with several local stores offers customers the possibility to buy on credit. About 50% of the total number of purchases is bought on credit. Recently the credit granting procedure is causing several problems.

Every store has one credit manager who is responsible for the decisions to grant credit or not. A customer, who wants to apply for credit, completes a credit application form.

Appendix 1 contains the credit application blank that is used by the department stores.

A skilled and experienced credit manager knows, by studying the application form, whether or not it is advisable to grant the customer credit.

For years this system functioned well. Recently however several problems have come to light:

1. There is a growing shortage of skilled, experienced credit managers. This leads to delays in the decision making process of credit granting. This in its turn causes a loss of customers.
2. Every department store more and more uses its own system of deciding whether or not to grant credit. This leads to inconsistency from store to store in credit granting decisions.
3. Credit granting decisions seem to vary from day to day.

Beside these problems the management identified two more bottlenecks:

More and more problems arise with customers not paying their credit or only after a lot of pressure and thus costs. This gives cause for the suspicion that too much credit is granted too easy to 'bad' customers. On the other hand, the management is concerned that the credit managers may be unjustly refusing credit to 'good' customers. This will reduce sales and profit.

To put it briefly: the management is very dissatisfied with the current credit granting system and wants to develop a new, preferably automated system, which can be used to decide fast and unambiguous whether or not it is wise to grant a certain customer credit.

This new decision system must be easy to use. Each relatively inexperienced sales person must be able to make a correct decision about granting credit by using this system. To design this new system the management set up a project team. This team includes mathematicians with statistical knowledge. You as a team are this project team.

The project team has selected a random sample of former credit applicants who received credit last year. This sample, in the form of an Excel-file, contains the following information from 200 customers: the relevant information from the application form; the amount of credit granted; and whether or not the customer paid back promptly. The project team wants to develop the new decision making-system, based on an analysis of the information in the customer-file.

Below you see the information on the first eight customers in the file. The complete Excel file with information on all 200 customers can be found on the disk or CD-rom. Appendix 2 contains a print-out of this file.

A	B	C	D	E	F	G	H
Customer number	Salary scale	Married/ living together	Time on present job	Credit-card	Children under 18 years	Credit granted	Prompt payment
1	2	No	2	Yes	No	2575	No
2	3	Yes	2	Yes	Yes	945	No
3	2	Yes	4	Yes	Yes	1360	Yes
4	3	Yes	2	Yes	Yes	65	Yes
5	3	Yes	3	Yes	Yes	3560	Yes
6	4	Yes	3	Yes	No	1620	Yes
7	4	No	1	Yes	No	2260	Yes
8	3	No	1	No	No	2155	Yes

Salary scale (monthly in € net)	
1	less than 1000
2	1000 to 1500
3	1500 to 2500
4	2500 to 4000
5	over 4000

Length of time on present job	
1	less than 6 months
2	6 months to 4 years
3	4 to 10 years
4	over 10 years

Entries in the last column H, Prompt payment, mean:

A **yes** means the 'good' customer who was granted credit, paid the amount back promptly without problems or extra costs. This means a profit for the store of 10% of the amount of credit granted.

A **no** means the customer did not pay promptly. The store has made costs to receive (part of) the payment. Some of these 'bad' customers did finally pay (part of) the credit granted. Because some customers did not pay at all, a **no** means an average loss of 20% of the amount of credit granted.

Problem 1

Investigate, using the data in the customer file (see disk or appendix 2), whether the factor *married/living together* (column C) tells you something about the creditworthiness of the customer.

Suppose you use this factor as the only criterium to decide whether or not to grant credit. Investigate, on the basis of the customer file, what the consequences will be.

In problem 1 you started the analysis of the customer file in order to design a new decision making system. It is likely that a system that takes into account more factors will render a better prediction about the creditworthiness of a customer.

In other words: a system based on more factors will likely reduce the chance of unjustly refusing credit to applicants and thereby of losing customers. Likewise probably the chance will be reduced that credit is unjustly granted to potential 'bad' customers, or defaulters.

Problem 2

Based on an analysis of the information in the complete customer file of 200 customers, design the best system to decide on granting credit or not.

Give a clear description of the method you used to get to this system. Explain your choices and decisions in the process.

Make a reasonable case, using for instance calculations or illustrations, for the fact that you designed a good performing, easy-to-use system. Make sure to demonstrate how well your system works for the 200 'former' credit applicants in the customer file. How many 'errors' does your system make? What are the costs involved? Etc.

Problem 3

Suppose you are not limited to the customer information available in the file. You may for instance design a new application blank.

Indicate which adjustments you would make to improve your decision-making system. Substantiate why you want to make precisely these adjustments and what improvements you expect of them. Take into account the privacy of the customers and the public acceptance!

Your improved system must still be easy to use and unambiguous.

Products

- Incorporate the results of problems 1 to 3 in a report for the management of the chain of department stores.
- As the project team, give a short presentation (5 minutes) in English - by order of the management - about your work. The managing directors of the British chain of department stores, who are also considering changing their credit decision-making system, form the audience.

Finale mathematics A-lympiad 2001/2002

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