



LIVERPOOL MATHEMATICAL SOCIETY

OPEN CHALLENGE

'06

First prize for teams £200

First prize for individuals £100

Prizes for runners-up

Teams can be of any size greater than one but the prize is independent of the number in the team

Certificates for good entries

Team Competition. Teams may be of any size (greater than one), but all members must be under 18 on 31.8.06. **Each team should submit a single set of answers to all SIX questions.** The first page should contain the printed name and address of the school and printed names and dates of birth of all team members.

Individual Competition. The individual competition is open to anyone who is under 18 years of age on 31.8.06. **You should submit answers to FOUR questions only.** The first page of your entry must contain your printed full name, school (including school address) and date of birth. If you are entering as a member of a team, you may **not** enter also as an individual.

Both competitions. Begin each problem on a separate sheet of paper. Credit will be given for partially correct working and bonus marks may be awarded for particularly good solutions.

A copy of our solutions will be sent to you if you enclose a stamped, addressed envelope, but we are not able to return entries.

Entries must be posted (either by teachers, or directly by individuals) no later than Friday 17 November 2006 to Mrs. A. Carter, The Queen's School, City Walls Road, Chester, Cheshire CH1 2NN.

Prizes and certificates will be presented at an evening of mathematical entertainment at the University of Liverpool next term to which all those who do well will be invited (including at least one from each school from which we receive entries).

LMS/BARCLAY'S SIXTH FORM POP MATHS QUIZ

Saturday 10 March 2007 10:00 a.m. – 2:00 p.m.

Liverpool John Moores University

FREE!

Teams compete in this Pub style Quiz

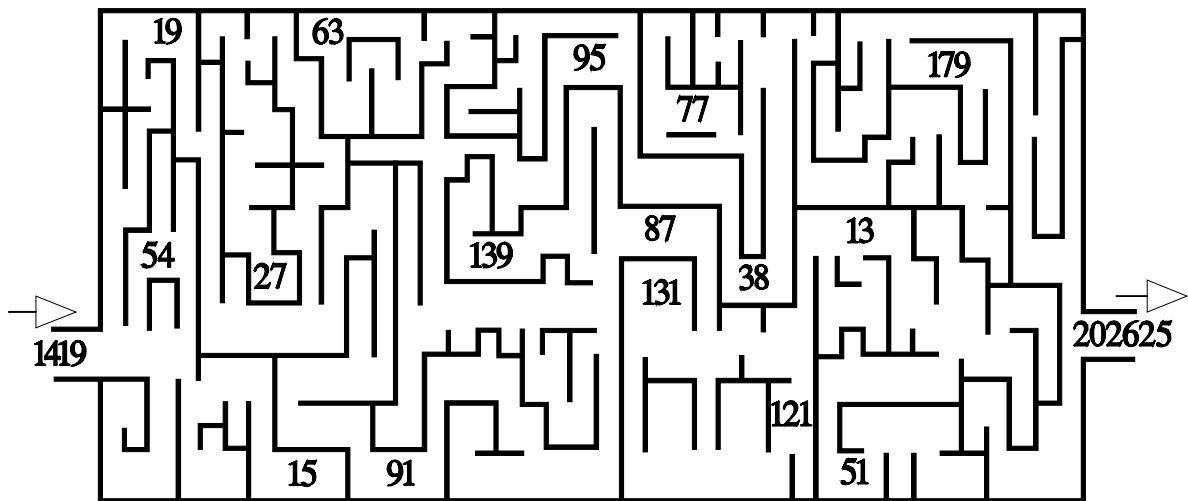
PRIZES GALORE!

The Liverpool Mathematical Society incorporates the Liverpool Branch
of the Mathematical Association.

The MA is a Registered Charity (No. 313281).

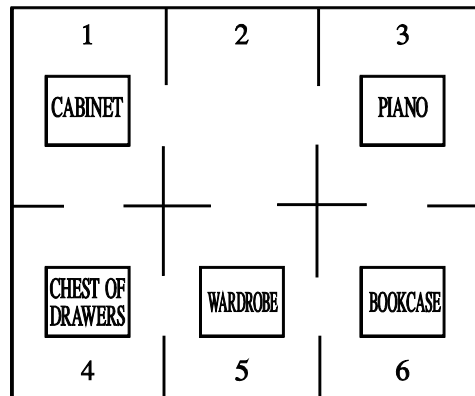
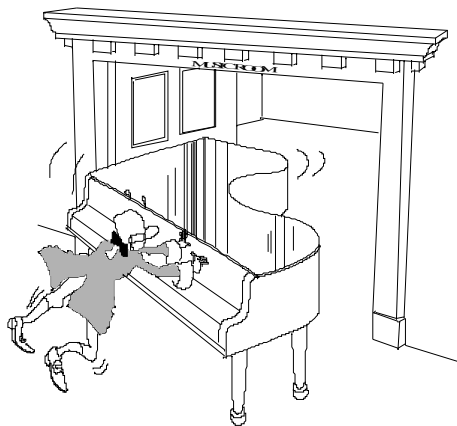
1. MAGICAL MAZE

Enter the maze on the left and leave by the shortest available path. However to leave you must reveal the password, the parts of which are collected along your path and decoded. These numbers are multiplied together to produce the coded password. The signs at the entrance and exit are in the same code, but they are not part of the password. What is the password?



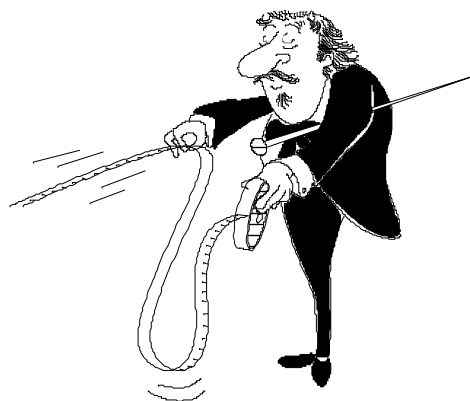
2. A LITTLE LIGHT MOVEMENT

The Mozart family secured an apartment in Salzburg. There were six rooms on the same floor all communicating as shown in the diagram. They could only afford rooms 4, 5 and 6 but were able to choose any three pieces of furniture. They decided to exchange the piano for the bookcase so that the piano was in room 6 and the bookcase was in room 3 but they also required the chest of drawers and the wardrobe. Now the rooms were so small that no two pieces could fit in any one room at the same time. How was this exchange to be made with the least possible labour?

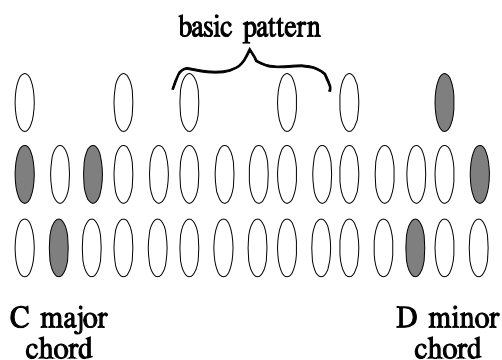


3. MIDDLE C

Sir Malcolm Corporal was a very particular conductor who required his principal flautist to be 15 feet from his percussionist and 14 feet from his oboist and his oboist to be 13 feet from his percussionist. He placed his clarinettist so that he was equidistant from the oboist, principal flautist and percussionist. Can you calculate this distance and if so what is it?



4. THE TRIANO



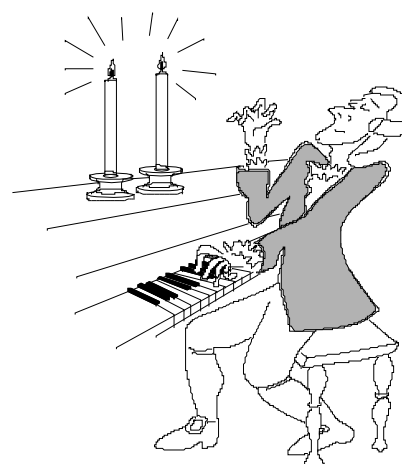
The triano was a prototype large keyboard instrument, with a very unusual pattern of keys, as shown in the diagram. There are two full rows of keys and one partial row, and between them all the notes are represented once each, over a number of octaves. Within each row (even the partial one) the keys from left to right

at any position the note produce increasingly high notes, and in the middle row is higher than that in the bottom row, and if there is a note in the top row at that position then that is higher still. The basic pattern of notes in the group of twelve shown is repeated along the keyboard, up by successive octaves to the right and down by successive octaves to the left.

The diagram also shows you how you can play the notes of a C major chord (C, E and G, but maybe in an inversion, i.e. not necessarily in that increasing order); the three keys for this are shown shaded, at the low end of the keyboard. At the high end of the keyboard some more shading shows how to achieve the notes of a D minor chord (D, F and A, again not necessarily in that order). So, what is the arrangement of notes within the basic pattern?

5. CANDLELIGHT SONATA

One evening, as Wolfgang started his practice, his father Leopold lit two apparently identical candles on the piano and then went out. Mozart extinguished both candles when he finished. The next morning Leopold noticed that what remained of one candle was exactly four times the length of what was left of the other. He knew that the candles were from two different batches, one of which would burn for four hours and the other for five hours. For how long did Wolfgang practise?



6. SALIERI'S CONFESSION?

Researchers were excited recently when they discovered what appeared to be a signed confession by Salieri, confessing to the murder of Mozart. The code is simple and in keeping with what was known about codes at the time, but closer analysis showed conclusively that it is a fake.

The find has here been converted into an English equivalent, and your challenge is to find out what the poison was, and why researchers are convinced this cannot be genuine.

URFTL WDQTM MSUOS TAWSL
TONTG IMSUH RUMJW IACDY
ITXRJ MDSTA WSUSM LINIA
LVIQR SMRUT NMIUS HLRFR
XKOTU OTWTA IJMWR BTNLT
UALVJ MQNRH JNIAV SMIUA
TUAWD TAGTU HIWIU LTULR
USRMT XSINS



LIVERPOOL UNIVERSITY MATHS CLUB

This highly successful club has been running for many years. It is ideal for students of Year10 or above who are keen to take on substantial maths challenges.

Sessions are held once a month on Saturday mornings during term time at Liverpool University.

More details are available from:
David Lewis d.m.lewis@liv.ac.uk
www.maths.liv.ac.uk/~mathsclub/