PUZZLES.

1. The problem of the jealous husbands.

Three married couple come to a river. The only vessel available is a small boat that can carry at most two of them. How can they cross the river, if at any time, no woman is in the company of any man unless her own husband is present?

Note: The foregoing problem is in an eighth century collection by Alcuin of York. The original Latin version is a little more salty: *Tres fratres erant, qui singulas sorores habebant, et fluvium transire debebant. (Erat enim unicuique illorum concupiscientia in sorore proxime sui.) Qui venientes ad fluvium non invenerunt, nisi parvum naviculam, in qua non potuerunt amplius nisi duo ex illis transire. Dicat, qui potest, qualiter fluvium transierunt, ne una quidam earum ex ipsis maculata sit? Three friends, each with a sister needed to cross a river. (Each of them coveted the sister of another.) At the river, they found only a small boat, in which only two of them could cross at a time. How did they cross the river without any of the women being defiled by the men?*

2. Water and wine.

You are given a litre of wine and a litre of water. A small cup of wine is transferred to the water vessel and thoroughly mixed. Then the same quantity is transferred from the water-wine mixture back to the wine container. At the end of the process, which is greater: the amount of wine in the water vessel or the amount of water in the wine vessel?

Note: A different version of the same problem uses a deck of cards. Separate the red cards and the black cards into two piles. Transfer seven of the red cards to the black pile and thoroughly shuffle. Now transfer seven cards from the shuffled deck back into the red pile. Are there now more or fewer red cards in the black pile and black cards in the red pile?

How well you do at this puzzle depends on how you frame it. If you focus on the fact that a pure liquid is moving in one direction and a mixed liquid comes back, then you are likely to think that one of the amounts is greater. However, if you ask yourself what displaces the wine originally removed when the process is finished, you will have a different perspective on the situation.

3. The twelve balls.

You have twelve balls, identical in appearance, eleven of which have the same weight. Using only an equal arms balance at most three times, determine the ball whose weight is different and whether it weighs more or less than each of the others.
Note: I learned this problem originally in the schoolyard, where there was a fairly robust practice, at least among the boys, of posing riddles and puzzles. I

suspect that some of the material came from fillers in *Readers Digest* which was widely read in those days.

4. The four couples.

Four couples meet for a dinner party. When they come together, some pairs hug each other. They do not hug themselves nor their own partners. One person, call him John, then asks each of the other seven how many that person hugged, and got seven difference answers. How many people did John's partner hug.

5. The Microsoft problem.

Four men are out walking on a very dark night with only one rather weak flashlight to guide them. They come to a rickety bridge that is capable of carrying at most two of them. So when there is a crossing, someone has to bring the flashlight back to enable the next one(s) to cross. Furthermore, they have different capabilities. One person takes 10 minutes to cross the bridge, the second takes 5 minutes, the third 2 minutes and the fourth 1 minute. When two cross the bridge together, they have to travel at the speed of the slower. What is the minimum amount of time required for all four to get over the bridge?

6. The rotating table: from Russia with love.

A square table has four deep wells in its surface, symmetrically placed. Inside each well is a drinking glass that may either be upright or inverted. It is known that they are not all in the same state. It is impossible to see inside any of the wells.

Your task is to get all of the glasses to the same state, either all upright or all inverted, using this process. The table rotates and stops at random. You are permitted to place your hands in at most two of the wells, determine the state of the glasses, and then turn over none, one or both of the glasses. If you succeed in getting them all to the same state, a buzzer sounds. If not, you withdraw your hands, the table rotates again and the manoeuvre repeats.

Can you guarantee that the task can be completed in a finite number of moves? If so, how can it be done?

Note: The situation is not completely random. There is actually a choice that can be made at each move. There is a variant of the problem where a robot puts its hands in two of the wells. You do not know the state of the glasses that the robot acts upon, but you can instruct the robot how the glasses are to be left.

7. The four cards.

Four cards lie on a table. On the sides facing up appear the symbols A, B, 1, 2, with one symbol on each card. What is the minimum number of cards that must be turned over in order to test the truth of the statement: *If a vowel appears on one side of a card, then an even number appears on the other side.*?

8. Truthtellers and liars.

An anthropologist is visiting an island on which every native is either a *truthteller*, one who always tells the truth, or a *liar*, one who always lies, She encounters three natives, A, B and C, and asks A which sort of person he is. However, as she cannot understand A's mumbled response, she asks B what A said, and B responded, "A said that he is a truthteller." At this point, C interjects, "Do not believe B; he is lying." What are B and C?

9. Guess my number.

Tristan and Isolde play the following game. Tristan chooses a number between 1 and 10 inclusive, and Isolde takes a guess as to what it is. If Peter guesses correctly then he wins. If not, Tristan chooses a number between 1 and 10 *that is one more or one less than the previous number*, and Isolde makes another guess. If Isolde guesses wrongly, then the game continues, with Isolde always selecting a a number that differs by 1 from his previous choice.

Isolde can find a strategy to be sure of winning this game. What might it be?

Note: The key observation to make is that the numbers selected by Tristan alternate in parity (even/odd) with each turn.

10. Twin purchases.

Castor and Pollux go to a flea market where everything is priced no more than a dollar. When they arrive, there are only ten items remaining for sale. However, regardless of the prices of the items, it is always possible for them to each buy separate bags of items for which the total cost is the same. Why is this so? (At least one item is purchased.)

11. Safe passage.

Goneril wishes to transmit a gold bracelet to Regan. Since the two are some distance apart, they must use a messenger. To ensure that the messenger does not steal the gold, the pouch must be sealed with a padlock. Both women have a supply of padlocks with their keys, but neither has a key for any of the padlocks of the other. However, it is possible to transmit the gold safely for Regan to access it. Explain how.