Diet Optimisation

	PRICE IN PENCE	PROTEIN mg	CARBOHYDRATE mg	FAT mg	CALORIES	QUANTITY REQUIRED
400g POTATOES	10	10	90	0	400	8.5kg
200g SARDINES	50	80	5	5	500	—
400g STEAK	240	150	10	80	1300	—
½ LITRE MILK	28	15	25	20	200	3.75 l
MINIMUM REQUIREMENT PER WEEK		250	1000	150	10000	

In this example, the object is to find the optimum combination of four foodstuffs that satisfies a specified minimum dietary requirement at the minimum cost. For this we must tell the computer: the nutritional components (pink) and price per unit (blue) of each foodstuff, and the minimum requirement of each nutritional component for the week (yellow). The computer finds the most critical element and manipulates the rest of the grid around it to find the optimum balance, shown here in green. In this example, the requirements have been satisfied with potatoes and milk only, at the minimum cost of £4.22½ per week. (N.B. this diet is not recommended)

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manufacturing. Cloth normally comes in standard units of width — and sometimes of length as well — and the manufacturers' problem is to minimise waste when cutting the cloth, while paying attention to factors like the direction of the nap of the fabric (the way the pile lies).

In one of the most advanced manufacturing tailors in Europe the placing of piece-patterns into a given length of material for the production of made-to-measure suits is worked out using optimising techniques, and the suggested result is shown on a visual display unit. At this point, using object-oriented programming methods (see page 262), the computer operator is requested to exercise his judgement and experience in an attempt to improve on the computer's calculation. The operator makes an improvement, on average, one time in five.

Because the requirements of each job, or each garment, are different, this is an excellent example of the intelligent use of low-level computerised optimisation combined with the experience of the operator. More comprehensive methods are used in industries that repeatedly cut identical objects from sheet material, where the full process of optimisation is allowed to run its course. Because the cutting or stamping operation forms part of a production line, the identical operation will be performed thousands of times. In this case, the cost of the optimisation process divided by the number of units manufactured is more than covered by the savings in wastage.

Critical Path Analysis, as its name suggests, is a method of determining the most important job stream in a manufacturing or construction process — that is, the part of the job with the greatest potential for holding up everything else if it is not completed on schedule. It is very firmly time-based, the period required for the execution of a segment being its value in the CPA diagram or table. Its most common use is during the planning stage of construction projects, so that the builders can allocate men and materials to the various aspects of the project in the right order — plumbing before floorboards, painters after plasterers. Once again, there are software packages available for a wide variety of microcomputers.

While the mathematics of the optimising process may be rather daunting to the untrained, there can be no denying the success and strength of the technique itself. It is one of the few 'number-crunching' tasks commonly carried out on small microcomputers, and is an important component in artificially-intelligent systems, replicating (as it so often does) applied common sense.

Motorway Madness

Apart from social factors, the design and routing of motorways, whether in town or in the country, is very dependent on optimising techniques. The architect will be most concerned with the gradient of hills and sharpness of bends, but the farmer whose land is taken over has a rather different set of criteria. When a new road is being planned a vast amount of data is gathered, which serves to make up a comprehensive model of the situation. This model is then used for a variety of purposes, from graphic representations to route optimisation

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