Gerald's Column
by Gerald Fitton

First a couple of general comments before reporting the correspondence I've received about the obsolescence of the electronic calculator.

Fireworkz

I have just received a copy of Version 1.24 with issue date 17 Jan 1996. I shall report on it next month.

Z88 Spellmaster

My public thanks to C Walker who has sent me this Computer Concepts package via the Archive office. It works very well − I will return it as soon as I've put it through its paces.

Impression

Also I have received a book for review called "Impression" by Dr Anthony Ward from paragon Publishing − 'phone 01604 832149. It costs £9.95 and has a lot of good stuff in it. For now let me say that it is full of Exercises for you to work through − I'll let you know more about it next month.

The Bi-directional Parallel Port

Earlier Archimedes computers, like the very early PCs, have a uni-directional printer port. Many years ago, I think it was about the time that the 80286 came out, PCs changed; the parallel port became bi-directional. I think the A5000 along with the A4 were the first Archimedes to have bi-directional printer ports. We all know that Archimedes computers last much longer than PCs − many Archive readers will still have a machine built six or seven years ago − whereas most PC users will have consigned their 80286 machines and even 80386 machines to the scrap heap!

One consequence of this obsolescence in the PC world is that it is unlikely that any PC user will still have a uni-directional parallel port whereas, as a consequence of the longevity of the Archimedes, many users will still have a uni-directional parallel port in their machine.

Some short while ago I reported that a few printers wouldn't work with the earlier Archimedes machines because those printers require a fully operational parallel port. I have further news − my source is a printer supplier who deals with both Archimedes and PC users but who wishes to remain anonymous (I'm not sure why but I must respect the confidence they've asked for). In the following, the words in brackets have been added by me in order to clarify the meaning of his comments. I do not take responsibility for the accuracy of what is said but I believe it to be true. I say this in the hope that, if the information is incorrect that HP won't sue me but will pass on to me correct information which, with Paul's permission, I shall be pleased to publish.

The printers in question are the HP DeskJet 660/850C about which my source says:

"HP have adopted the use of a high speed bi-directional interface on most of their later printers because this is necessary for the sophisticated Windows drivers. It is through the bi-directional interface that the ink cartridges are aligned. Even with the (bi-directional) A5000 there are inconsistencies with Acorn's latest drivers which result in reduced print quality and unacceptably slow operation. Hewlett Packard have not released the control codes which can be used to align the print head so it is not possible for Acorn (or Computer Concepts or any other writer of printer driver software) to write drivers which overcome this problem. Price pressure on the market for printers make it increasingly likely that they will make use of the intelligent (bi-directional) Windows interface and that, as a consequence, this problem will become worse."

My comment is that it is becoming increasingly important that, when you buy a new printer, you do so from an Archimedes supplier who knows and understands the nature of this 'bi-directional' problem. Don't buy a printer from your local high street PC vendor − it may not work!

The Heinz Beans Can

In a letter I received from Colin Singleton he expresses the wish that he had included this as one of his now famous puzzles. As a consequence I have decided not to give you the solution at this point but to leave you to discuss it with Colin for possible inclusion in his puzzle column.

If you missed the problem it is this. Consider a circular based cylindrical can (similar to a can of Heinz Beans). For a fixed volume you can have a can with a large diameter base but a small height (like a cake tin or the traditional salmon tin) or you can have a small diameter base but a large height (like a tube or extended telescope); or you can have something in between! As you vary the base diameter from large to small the amount of material used for the ends of the can gradually reduces but the material used for the curved portion gradually increases. There is some shape which minimises the surface area of the can. When you find that shape what is the ratio of the diameter to the height? And can you prove it?

An extension of the problem is this: What shape gives the minimum surface area for the given volume? Is it better to have a rectangular base, a square base or a circular (or even elliptical) base for the cylinder? Indeed, what shape, for example a tetrahedron or even a dodecahedron (ie not necessarily a cylinder) gives the minimum surface area and what is the ratio of the areas for the optimum square base, circular base and ultimate shape?

If you decide to use a numerical method for determining the optimum and want to fully automate the process then here's a hint. Choose three points which bracket the minimum. Evaluate the function at all three points and then evaluate the function at two more points, one half way between the first pair taken from the three and the other half way between the second pair. From the five points choose the three which give the smallest values for the function. Having done that then repeat with the three new points. Continue until the method converges. If you create a spreadsheet for doing this then please let me have a copy − my students and I will be most interested. By the way, using the Archimedes in double precision mode (15 significant figures) you should be able to get the 'correct'

answer (a linear dimension) to about 7 significant figures − after which any accuracy you think you've got will be illusory!

The Professor

Now to my main theme for this month, the obsolescent calculator.

I have received so many interesting letters about the demise of the calculator and its replacement by the spreadsheet I am so unsure where to begin that I'll start with a reminiscence from Professor John Greening! John says that, once upon a time, he worked at the National Physical Laboratory designing aeroplane wing sections. Spreadsheets, the paper ones were used to do the sums. He used, as we did at Vickers, the Brunsviga and Marchant mechanical calculators as calculating aids. He says that, in those days Computers were people who did such sums and that is how he met the lady who is his wife. John's experience mirrors my own in that Jill, my wife, was one of many Computors (I thought they were spelt with an o and not an e) who did sums for me. At Vickers Computors were invariably girls because they were cheaper to employ! In his letter John says that it was his wife who taught him how to extract square roots on a mechanical calculator. I remember well the day I decided to teach Jill the same operation! It was one of those 'Red Letter Days' I shall never forget.

Whilst this reminiscence gives me much personal pleasure you may wonder where I'm leading with this story of John and I spending time courting the extraction of square roots. Bear with me; I am, in my usual digressive way, introducing a subject which I'm sure you'll find interesting.

The PhD

The next point in this series of digressions is best illustrated by another letter I got from a PhD (who wishes to remain anonymous − I think he's still with the company referred to in his letter even though it happened a long time ago). Whilst doing his PhD he had developed extraordinarily clever techniques for solving particular types of super hard partial differential equation. During an early part of his long employment with the (unnamed) company he had been asked to find a solution to a similar but different set of partial differential equations! He spent many weeks trying to find an analytical solution (ie by using formula and symbols) without success. Then he went to his immediate superior who, in a few short lines of 'heavy' maths, demonstrated that an analytical solution to the problem could never be found. My PhD correspondent was dumbfounded. He has sent me the proof of the non existence of an analytical solution; it is valid and quite clever. His reaction (he says) was to be asked to be put onto another problem "worthy of his talents". He says that he was told to solve the problem using a numerical method or find another job! He had little experience of numerical methods but found a Computor (amongst those allocated to him) who was kind, taught him much about numerical methods, saved his job for him (so he says) and who, after showing him how to extract square roots, became his wife!

The point I wish to make here is that, even in those days of long ago when Computers were Computors (and PhDs pleased that they were), analytical methods, so beloved by Professors, PhDs, A level teachers and even myself (yes! I've been there too), have their

serious limitations! Sometimes, indeed all to often, numerical methods are the only way.

The Teacher

Where now in my digressions and correspondence shall we go? I have received many letters (as I knew I would) challenging my comment that the electronic calculator was on the way out. All these letters have a particularly interesting feature in common (which we'll come to in a moment). Those who support the calculator point to all the new and advanced features of the 'modern' version of this device. They will plot graphs, find turning points (maxima, minima and even points of inflexion), solve quadratics, differentiate analytical functions, indeed, their only drawback is that they all have a square root key, thus preventing the teaching of square root extraction, a proven method of encouraging matrimony between Mathematicians and Computors.

I have no doubt that my correspondents are right when they say that the 'modern' calculator is more of a micro computer than a plain old fashioned calculator. Indeed the best of them include a 'lexical analyser'. In case you don't know what I'm talking about, a lexical analyser is a package which will disassemble text, allow the disassembled text to be processed and then put it all back together again. An example of text which might be processed by a lexical analyser is the function $y = x*sin(x)$. Suppose we want the formula which is the first derivative of this function (ie a formula for the slope of the original curve) then we can use the lexical analyser to split the function into its parts, use a process known as 'differentiating a product of two functions' and finish up with the solution $y' = x*cos(x) + sin(x)$. I remember that there was a package available for the old BBC computer around 1983 which would find the derivative of a product of two (or more) functions; it had a built in lexical analyser. I feel sure that something similar must exist for the Archimedes, however, I don't know of one and, if it doesn't exist, then this is indicative of something relevant to my story (so please let me know if you've seen a 'differentiate' package).

The correspondents who support these 'modern' calculators have one thing in common. They all teach mathematics, they teach solving equations, they teach differential (and integral) calculus, they teach graph plotting. Maybe some of them teach numerical methods of solving problems but none have said so; one thing for sure, they won't teach potential computors what is, apparently, a certain method of improving their prospects of a good marriage, namely knowing how to extract square roots!

I have no wish to upset teachers of mathematics but I must make my point. The 'modern' features of these calculators will be of more use to A Level students of Pure Maths than they will be to those who need to do lots of sums.

The Computor

Where now on the trail of the square root of two? I have had many letters from scientists and engineers and a few from people in business. Apart from universally complaining about the inability of many school leavers to perform simple arithmetic without a calculator (eg "They can't answer the question 'How many pennies are there in £2.35?' without a calculator") there is general agreement that being able to solve analytical equations, find the turning points of continuous functions, etc, has limited application.

Some suggest that A Level Maths is useful only for those going to university! What they want are 'Computors' − people who can carry out computations accurately with modern tools. By "modern" they definitely do not mean calculators with what I have called 'modern' features − they mean electronic spreadsheets.

In business, in science and in engineering the mathematical functions involved are generally not analytical and they are often discontinuous. There is no way in which the techniques of the 'modern' calculator can be used with these functions. For centuries the tool of preference for doing sums, particularly on 'funny' functions has been the paper based spreadsheet (with a formula at the head of each of the columns). I believe that the spreadsheet, brought up to date by using an electronic computer, will be the tool of preference for large scale number crunching into the foreseeable future. Many in business, science and engineering agree with me.

Finally, of the many letters I've had from practising 'computors' I must select one. A lady called Susan Jones has sent me a disc file in PipeDream format which gives a practical algorithm based on the *(x + y)^2 = x^2 + 2*x*y + y^2* formula I quoted for extracting square roots using an electronic spreadsheet. She says that it was taught to her by her grandmother (a former Royal Aeronautical Establishment computor from Farnborough) at the tender age of eight. I must congratulate the grandmother; it seems obvious to me that, of the many facts of life, she was acutely aware of the one which would make her young grand daughter eligible and at the same time enable her to indicate that she had selected her lifetime partner. I must add that Susan Jones signs herself as a Miss so, to quote her, she "has not yet come across the Mr who is worthy to receive this secret aphrodisiac algorithm inherited from my grandmother". I had considered putting Susan's grandmother's algorithm on the Archive monthly disc but, after careful consideration, I decided that it would be a breach of confidence!

In Conclusion

A heartfelt "Thank You!" to all of you who have written to me and shared your reminiscences with me. Many of your letters included stories which I found nostalgic, amusing and interesting. Please write to me at the Abacus Training address on the back cover rather than via the Archive office. It's much faster.