Is it time to retire FORTRAN?

FORTRAN or Mathematical Formula Translating System was the world's first widely available high-level language. Backus was working on the hardware development of the IBM 704, the successor to IBM 701 when he got the idea of developing a sophisticated language and compiler that would make programming the IBM 704 a less onerous task. Backus's system aimed at allowing the *user to write programs in algebraic notation* and the compiler would translate the user program to machine code automatically.

The development of FORTRAN was started by Backus and his team in 1954 and was first available to users in 1957. The introduction of FORTRAN was probably the most important milestone in the history of computer languages. Most scientists and engineers had little patience to use machine language or even assembly code which required a reasonably comprehensive knowledge of the computer hardware. The advent of FORTRAN changed all that and computing was never the same again.

Today, the computer scientists view FORTRAN as a relic of the past. It has been called a 'dinosaur', an 'intellectual roadblock' and even a 'collection of warts held together by bits of syntax'. Some educators now believe that teaching of FORTRAN should be regarded as a criminal offence! Nevertheless, four decades after its inception, FORTRAN remains the most popular of computer languages with an enormous number of users. There have been several debates on whether the time has come to 'retire' FORTRAN. So far, FORTRAN has survived all criticism and continues to be the main programming language of a certain class of programmers.

Why is FORTRAN being decried so vehemently? Well, the answer is that FORTRAN does not impose any discipline on the programmer. One can mix integers with real variable, one can introduce new variables in the middle of *the program, there is no concept of 'self-*documentation'. In short, it is the very antithesis of the modern-day concept of structured programming. In the days when FORTRAN was first introduced, these did not seem to be restrictions and were in fact viewed as advantages—which scientist would not love the flexibility of FORTRAN.

In the 1950's and even in the 1970's computers were mainly used for off-line processing of a scientific or commercial nature. With the advent of powerful, low-cost microprocessors, computers entered the area of direct digital control. In several applications such as modern-day aircraft, it is the processors which keep the vehicle under control. The software is complex and runs into several million lines of code. The software (which hitherto was literally free) costs often exceed the hardware costs several-fold. How does one manage a team of engineers developing such a complex code? How does one maintain such software? How does one *ensure that such codes do not have errors* or 'bugs'? It is in answer to such practical problems that the use of FORTRAN in today's formal software has virtually disappeared. It is virtually impossible to wade through one's own FORTRAN program after a few months. Maintenance and bug fixation of someone else's code is a nightmare which no project manager would like to even think about.

On the other hand, one cannot dismiss FORTRAN all that lightly. Most scientists are very comfortable with it. For scientific computations, it is almost tailor-made. Besides this, most scientists have invested *time in developing a huge software base* of programs that have been painstakingly written, tested and verified. While one may criticize such programs as being unstructured, patch-up jobs, the merit is that **they work**. It is therefore unlikely that FORTRAN will be abandoned in a hurry. As long as the tendency to use those 'dusty deck' programs is there, FORTRAN will survive.

In fact, FORTRAN standardization is a continuing affair with newer releases like FORTRAN 8X catering for vector constructs and communications for use in parallel processing. This reinforces the fact that FORTRAN continues to be used on modern-day computers. The debate on the pros and cons of FORTRAN may rage on but FORTRAN is presently echoing the sentiments of Robert Frost:

"... miles to go, before I sleep ...".

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Indian Science Congress—Need to make it a stock-taking affair

The annual meet of our scientists at the Indian Science Congress is an excellent opportunity to focus national attention to science and scientists in India. This event has three media-friendly factors in its favour, inauguration by the Prime Minister, convening in the first week of a new year and the presence of a galaxy of 'who is who' of Indian S & T. This national initiative needs to be restricted and restructured as an annual stock-taking affair in the field of S & T, if we are keen on boosting the complexion of the Indian Science Congress.

Stock-taking affair means to simply bring out an activity report *not* status of our S & T in the preceding year. Releasing the Annual Report of Indian S & T means ensuring due attention to our own S & T achievements by the media with little extra effort. Inauguration by the Prime Minister means sensing the mood of the government, and hoping for its continued support of our on-going programmes and projects.

Interestingly, the focal theme of the 1994 Jaipur session of the Science Congress 'Science in India: Excellence and accountability' was just apt. In fact, such a realistic focal theme needs to be con-

tinued till we get another Nobel Prize. C. V. Raman continues to be the only Indian scientist to have been awarded the Nobel Prize way back in 1930 *for work done in India, viz.* the 'Raman Effect'. However, to honour this great discovery, since 1987, 28 February is being celebrated as the National Science Day.

The presentation of research papers at the Congress needs to be minimised if *not* scraped altogether in the week-long session as there is every conceivable opportunity round the year to do this both in India and abroad.

The annual stock-taking of the Indian Science Congress will hopefully convince the taxpayers that their money is being spent on S & T in a meaningful manner.

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A modified alkaline lysis procedure for isolation of plasmid from *Escherichia coli*

IN recent years several methods have been developed for isolation of plasmids from *E. coli* [1–6]. But the widely used method is the alkaline lysis procedure of Birnboim and Doly[1]. This method makes use of sugar solutions such as glucose or sucrose in the initial buffer. Under laboratory conditions, the sugar solutions are easily contaminated and hence it becomes necessary to prepare fresh sterile solutions each time. To circumvent this problem, an alternative method has been standardized using sodium chloride solution instead of sugar solutions which can be stored for prolonged periods and needs neither aseptic transfer nor refrigeration as is required for sugar solutions. The modified procedure was tested on small-scale and large-scale isolation of plasmids. DNAs thus obtained were tested for their digestibility with restriction enzymes and for their transformation efficiency.

For small scale isolation of plasmids, the bacterial strain harbouring the plasmid pUC18 was streaked on a LB plate containing ampicillin (50 µg/ml) and incubated for about 12 h at 37°C. A single large, well-isolated colony was transferred into 10 ml LB medium containing ampicillin (50 µg/ml) and was grown on a shaker for about 10 h at 37°C at 200 rpm. The flask was placed on ice for about 15 min and 1.5 ml of the culture was centrifuged for 3 min in a microcentrifuge at room temperature (30° ± 3°C). The cell pellets were suspended by vortexing in 100 µl of either TEN (Tris 50 mM, pH 8.0; EDTA 12.5 mM, pH 8.0; NaCl 0 to 500 mM) or TES (Tris 50 mM, pH 8.0; EDTA 12.5 mM, pH 8.0, glucose 0 to 5% or sucrose 8%). To the suspended cells, 50 µl of freshly prepared solution II (0.2% SDS and 0.2 N NaOH) was added and mixed gently by inverting the tubes a few times. The tubes were placed on ice. Once the suspension became viscous indicating cell lysis (in about 5–10 min), 75 µl of ice-cold 3 M potassium acetate (pH 4.8) was added and mixed gently by inverting the tubes. The tubes were placed on ice for 15 min and then centrifuged for 10 min at room temperature. About 175–200 µl of the supernatant was carefully removed and the nucleic acids were precipitated with 2 vol. of distilled, cold ethanol at –20°C for 60 min. The precipitate was collected by centrifuging the tubes for 10 min at room temperature. The pellets were air-dried and dissolved in 50 µl TE (Tris 10 mM, pH 8.0; EDTA 1 mM pH 8.0). Ten to 15 µl of the plasmid preparation was analysed on a 0.8% agarose gel. Figure 1 shows the effect of different concentrations of NaCl, glucose and sucrose. There were no differences in the pattern of plasmid bands prepared using either NaCl or sugar solutions except at 500 mM NaCl where two extra bands appeared at the expense of two regular bands. In the control (i.e.) in the absence of NaCl or sugar the top chromosomal DNA band appeared as a smear. When the preparations were treated with RNase and digested with the restriction enzyme HindIII, the plasmid was completely digested in all three preparations viz. NaCl, glucose and sucrose (data not shown).

For large scale isolation of plasmids, the plasmid was amplified as described by Maniatis *et al.*[1] and extracted essentially as described above for small-scale isolation. The cell pellet from 500 ml amplified culture was resuspended in 10 ml TEN (the NaCl concentration was 150 mM) or TEG (the glucose concentration was 1%), lysed by adding 5 ml solution II and precipitated by adding 7.5 ml cold 3M potassium acetate. All centrifugations were done at 12,000 g for 10 min at 4°C. The final pellet was dissolved in 500 µl TE. The amount of DNA obtained from glucose and NaCl procedures was quantitated after RNase digestion and precipitation. The yields with glucose and NaCl were 3.45 mg/l culture and 7.41 mg/l culture, respectively. The 260/280 ratio was 1.95 in both the cases. DNA samples (obtained after RNase digestion) from both preparations were digested completely with HindIII.

The transformation experiment was done essentially as reported by Cohen *et al*[8]. *E. coli* strain C600 was grown on LB containing 20 mM $MgSO_4$ to an A_{600} of 0.5. Two hundred µl of $CaCl_2$-treated cells were transformed with 50 ng of plasmid DNA. Both preparations showed similar transformation efficiency (i.e) 0.93×10^6 and 1.27×10^6 transformants/µg of plasmid DNA prepared using NaCl and glucose, respectively.

In order to find out whether the method is applicable to other plasmids, pBR322 was also prepared using different concentrations of NaCl and sugar solutions. There was no change in the pBR322 profile and the plasmid was completely digested irrespective of whether the plasmid was prepared using NaCl or sugar solutions (data not shown). We have also tested the method with a large plasmid (28 kb) from *Agrobacterium tumefaciens*. The modified procedure is equally efficient to isolate the large plasmid too and the plasmid DNA was readily digested