## Review: The Boston Computer Society's IBM PC & Compatibles Technical Word Processor Review

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The September 11 meeting of the PC Technical Group of the Boston Computer Society (BCS) was devoted to scientific word processing programs which run on IBM PC and PC compatibles. A ten-month study of such programs preceded the meeting, and culminated in a lengthy, comprehensive report. The authors of the report are Avram Tetewsky, Charles Stark Draper Lab, and Jack Pearson, Avco Systems. TeX, in the MicroTeX and PC TeX implementations, was one of the programs examined in the study.

The aims of the study were: "firstly, to define the needs of the review committee members (which varied across several technical disciplines) as well as those of a wider cross-section of users; secondly, to make these needs known to software vendors — so that they can better understand and respond to user needs; and finally, the committee members themselves wanted to see what was available."

These areas in particular were examined:

- user interface — WYSIWYG vs. markup;
- customizability — fixed or open selection of fonts, macro command language, screen and printer drivers;
- ability to interchange text data with other systems;
- quality and speed of hardcopy output;
- competence in handling technical material, as demonstrated by the ability to cope with a selection of benchmark examples;
- ease of use — how much *brainware* is required.

The results of the analyses appear in short reviews of each program, and in six summary tables. Vendor names and addresses are listed, as are references for further reading. In all, 38 vendors are listed, supporting 36 programs. 10 programs are reviewed in more or less detail (TeX accounts for two of the ten), and summary information is given for 22 others, for which there was not enough time to complete the benchmarks or for which testable copies were not available. Tabular information includes such things as price, hardware requirements, file formats, physical features which can be customized (fonts, printer, etc.), benchmark results, program features available (footnotes, tables, etc.), "add-ons" available (hyphenation, spelling checker, spreadsheet, etc.), and documentation quality. Finally, there is some information on programs available for non-IBM PCs, including CP/M, Macintosh and 68000 systems (there is speculation as to whether TeX can be brought up on the Mac; the latest information available to TUGboat on this and other items has been provided to the authors of the report).

TeX was reviewed by A. G. W. Cameron, Harvard College Observatory (a TeX user with a year's experience), and Jack Pearson (a new user). The review gives a general introduction to TeX, and explains why TeX is not a "word processor" in the same sense as the other programs tested. It examines the technical differences between MicroTeX and PC TeX, and finds them both to be "excellent implementations of TeX". Differences between the two are attributed to the release level (MicroTeX = 1.4 and PC TeX = 1.0) and to the language of implementation (PC TeX is implemented in Pascal and assembly language, and MicroTeX in a C translation). One obscure bug was found in MicroTeX, and both MicroTeX and PC TeX had memory problems when asked to produce Benchmark 10, a composite of the first nine. (The developers were informed of all problems; both companies are now preparing TeX 1.5 for release.) The enthusiasm of the reviewers is evident in abundance, although they admit that considerable "brainware" is needed. The conclusion: "...I am convinced that TeX systems are in a class by themselves. The TeX user has power and flexibility unmatched by any conventional word processor. ... I suspect that soon a lot of people will be using TeX systems for [many kinds of nontechnical documents]. Why? Simply because if one person or business uses TeX, those who don't will look relatively crude in comparison. And no one wants his competition to have that kind of an edge."

The demonstration version of the benchmarks was prepared in TeX by Dr. Cameron, who has kindly provided to TUGboat his source file, which was used to generate the output below. (His article describing the code used to generate Benchmark 7 appears on page 155.)

By arrangement with the authors and the BCS, the report will be published in the *Notices of the American Mathematical Society* early in 1986. (Some other articles on subjects related to TeX and technical word processing will also appear in that publication.)

This review is based on a draft of the BCS report, and some changes can be expected in the published version. Copies of the BCS report may be obtained by sending a check for $8 (payable to him) to

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**Benchmark 1:**

Tsang, L., and Kong, J.A., *Journal of Applied Physics*, **51**(7), July 1980, page 3471, equation 110.

$$W^{3\beta}_{m_1 n_1 n_2}(p_1,p_2) = U^{3\beta}_{m_1 n_1}(p_1,p_2) + \int_0^\infty \frac{dp_3 p_3^2}{8\pi^3} \sum_n \sum_m \sum_{\alpha_2} \sum_{\beta_2} \sum_{n'} \sum_{n''} (-1)^m$$
$$\times \left( \frac{U^{33}_{m_1 n_1}(p_1,p_2)}{p_3^2 - k^2} \right) z_{3m_1 n_1} h_n(p_3,p_2) \cdot a^{\alpha_2 3}_{mn(m_1-m)n'n_2} a^{\beta_2 \beta}_{-mn(-m_1+m)n''n_2} W^{\alpha_2 \beta_2}_{(m_1-m)n'n''}(p_3,p_2). \qquad (110)$$

**Benchmark 2:**

Papoulis, Athanasios, *Probability, Random Variables, and Stochastic Processes*, McGraw-Hill, 1984, page 17.

*Unions and intersections* The *sum* or *union* of two sets $\mathcal{A}$ and $\mathcal{B}$ is a set whose elements are all elements of $\mathcal{A}$ or of $\mathcal{B}$ or of both (Fig. 2-3). This set will be written in the form

$$\mathcal{A} + \mathcal{B} \qquad \text{or} \qquad \mathcal{A} \cup \mathcal{B}$$

The above operation is commutative and associative:

$$\mathcal{A} + \mathcal{B} = \mathcal{B} + \mathcal{A} \qquad (\mathcal{A} + \mathcal{B}) + \mathcal{C} = \mathcal{A} + (\mathcal{B} + \mathcal{C})$$

We note that, if $\mathcal{B} \subset \mathcal{A}$, then $\mathcal{A} + \mathcal{B} = \mathcal{A}$. From this it follows that

$$\mathcal{A} + \mathcal{A} = \mathcal{A} \qquad \mathcal{A} + \{\emptyset\} = \mathcal{A} \qquad \mathcal{I} + \mathcal{A} = \mathcal{I}$$

The *product* or *intersection* of two sets $\mathcal{A}$ and $\mathcal{B}$ is a set consisting of all elements that are common to the sets $\mathcal{A}$ and $\mathcal{B}$ (Fig. 2-3). This set is written in the form

$$\mathcal{A}\mathcal{B} \qquad \text{or} \qquad \mathcal{A} \cap \mathcal{B}$$

**Benchmark 3:**

Feynman, Richard P., *The Feynman Lectures in Physics*, Addison-Wesley Publishing Co., Vol. 3, page 20-12, Table 20-1.

**Table 20-1**

| Physical Quantity | Operator | Coordinate Form |
|---|---|---|
| Energy | $\hat{H}$ | $\hat{\mathcal{H}} = -\frac{\hbar^2}{2m}\nabla^2 + V(r)$ |
| Position | $\hat{x}$ | $x$ |
| | $\hat{y}$ | $y$ |
| | $\hat{z}$ | $z$ |
| Momentum | $\hat{p}_x$ | $\hat{\mathcal{P}}_x = \frac{\hbar}{i}\frac{\partial}{\partial x}$ |
| | $\hat{p}_y$ | $\hat{\mathcal{P}}_y = \frac{\hbar}{i}\frac{\partial}{\partial y}$ |
| | $\hat{p}_z$ | $\hat{\mathcal{P}}_z = \frac{\hbar}{i}\frac{\partial}{\partial z}$ |

In this list, we have introduced the symbol $\mathcal{P}_x$ for the algebraic operator $(\hbar/i)\partial/\partial x$:

$$\hat{\mathcal{P}}_x = \frac{\hbar}{i}\frac{\partial}{\partial x}. \qquad (20.60)$$

**Benchmark 4:**

Brogan, W.L., *Modern Control Theory*, QPI Quantum Press Inc., Prentice Hall, 1982, page 180, Figure 9.11.

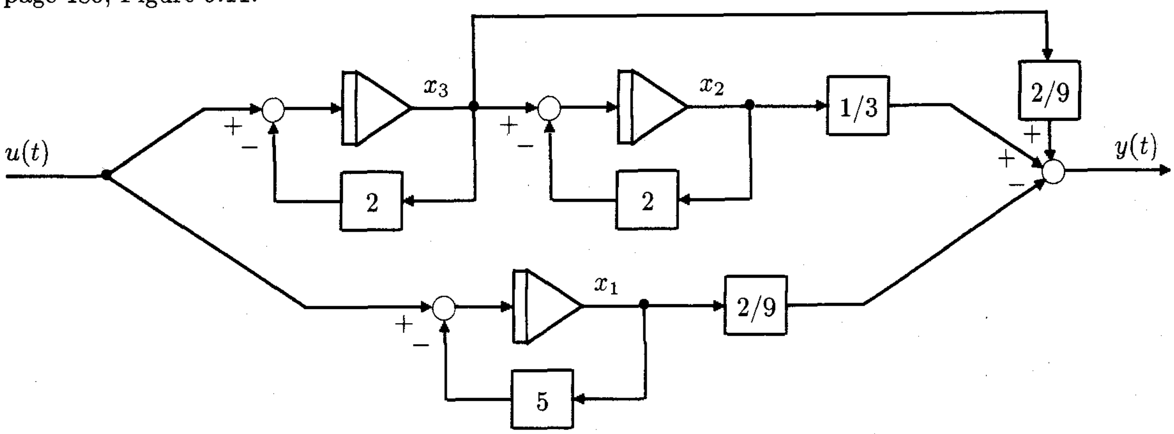



**Fig. 9.11**

From Fig. 9.11,

$$\begin{bmatrix} \dot x_1 \\ \dot x_2 \\ \dot x_3 \end{bmatrix} = \begin{bmatrix} -5 & 0 & 0 \\ 0 & -2 & 1 \\ 0 & 0 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} u \qquad \text{and} \qquad y = [\,-2/9 \quad 1/3 \quad 2/9\,]\, x$$

**Benchmark 5:**

Marsden, J.E., *Elementary Classical Analysis*, W. H. Freeman and Co., 1974, page 234, proof of Theorem 2.

*Proof:* Define the function $G : \mathbf{A} \subset \mathbf{R}^n \times \mathbf{R}^m \to \mathbf{R}^n \times \mathbf{R}^m$ by $G(x, y = (x, F(x, y))$. Since F is of class $C^p$ and the identity mapping is of class $C^\infty$, it follows that $G$ is of class $C^p$. The matrix of partial derivatives of $G$ (Jacobian matrix) is

$$\begin{pmatrix} 1 & 0 & \cdots & 0 & 0 & \cdots & 0 \\ 0 & 1 & & & & & \\ \vdots & & \ddots & \vdots & \vdots & & \vdots \\ 0 & & \cdots & 1 & 0 & \cdots & 0 \\ \dfrac{\partial F_1}{\partial x_1} & & \cdots & \dfrac{\partial F_1}{\partial x_n} & \dfrac{\partial F_1}{\partial y_1} & \cdots & \dfrac{\partial F_1}{\partial y_m} \\ \vdots & & & \vdots & \vdots & & \vdots \\ \dfrac{\partial F_m}{\partial x_1}. & & \cdots & \dfrac{\partial F_m}{\partial x_n} & \dfrac{\partial F_m}{\partial y_1} & \cdots & \dfrac{\partial F_m}{\partial y_m} \end{pmatrix}$$

**Benchmark 6:**

Henry, Allen F., *Nuclear Reactor Analysis*, MIT Press, Cambridge, Mass, 1982, page 495, equation 11.4.19, subequations 4 and 5.

$$iB_r[\tilde a^n_{kl}] \equiv \frac{1}{2}(h_{n-1} + h_n) \int_0^R 2\pi r\, dr [\rho_k^{n*}(r)] \frac{d}{dr}[\Psi_l^n(r)],$$

$$[D^n_{r,kl}]^{-1} \equiv \int_0^R 2\pi r\,dr \int_{z_n-\frac{1}{2}h_n-1}^{z_n+\frac{1}{2}h_n} [\rho_k^{n*}(r)][D^{-1}(r,z)][\rho_l^n(r)],$$

**Benchmark 7:**

Guendelman and Radulovic, "Infrared Divergence in Three-Dimensional Gauge Theories", American Physical Society, **30**, No 6, 15 Sept 1984, page 1347, Figure 13.

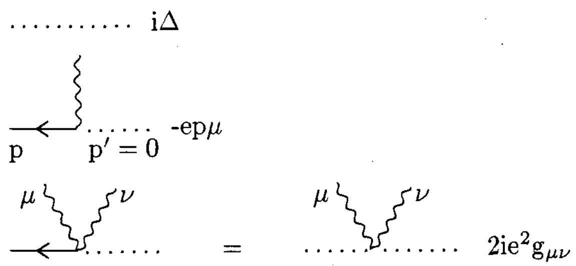
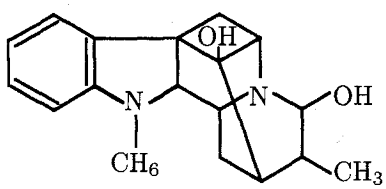


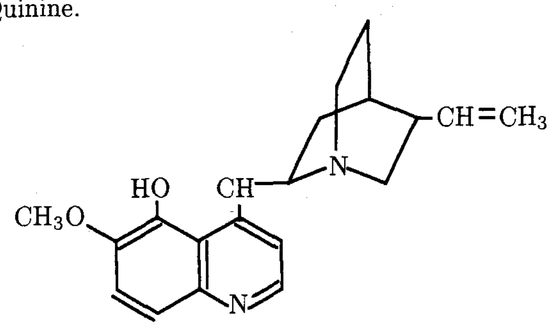

FIG. 13. Feynman rules for the $\phi_c$ scalars.

**Benchmark 8:**

Hendrickson, Cram and Hammond, *Organic Chemistry*, McGraw-Hill, 1970, page 1078, Figure 27-6, Ajmaline and Quinine.




Ajmaline




Quinine

**Benchmark 9:**

The following expressions.

$f_{\underline{Z}}(\underline{Z})$ $\quad$ $f_{\underline{y}}(\underline{y})\cdot e^{\alpha^{\beta}}$

**Benchmark 10:**

Place benchmark examples 1 through 9 in one file. See if:

(1) pagination works, and

(2) the system has enough memory or stack to do the work.