BOSTON COMPUTER SOCIETY BENCHMARKS

The following benchmarks are used by the Boston Computer Society in their evaluation of Technical Word Processing systems (TWPs). Each benchmark is a fragment of text from a scientific publication.

Benchmark 1:

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

$$W^{3\beta}_{m_1n_1n_2}(p_1,p_2) = U^{3\beta}_{m_1n_1}(p_1,p_2) + \int_0^\infty \frac{dp_3p_3^2}{8\pi^3} \sum_n \sum_m \sum_{\alpha_2} \sum_{\beta_2} \sum_{n'} \sum_{n''} (-1)^m$$

$$\times \left(\frac{U^{33}_{m_1n_1}(p_1,p_2)}{p_3^2-k^2} \right) z_{3m_1n_1} h_n(p_3,p_2) \cdot a^{\alpha_2 3}_{mn(m_1-m)n'n_2} \alpha^{\beta_2\beta}_{-mn(-m_1+m)n''n_2}$$

$$\times W^{\alpha_2\beta_2}_{(m_1-m)n'n''}(p_3,p_2). \qquad (110)$$

Benchmark 2:

Athanasios Papoulis, *Probability, Random Variables, and Stochastic Processes*, second edition, 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

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

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

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

Benchmark 3:

Richard P. Feynman, *The Feynman Lectures in Physics*, Addison-Wesley Publishing Co., 1965, Vol. 3, page 20-12, 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 $(\hbar/i)\ \partial/\partial x$:

$$\hat{\mathcal{P}}_x = \frac{\hbar}{i}\frac{\partial}{\partial_x}$$

Benchmark 4:

William L. Brogan, *Modern Control Theory*, QPI Quantum Press Inc., Prentice Hall, 1984, page 240, Figure 9.11.

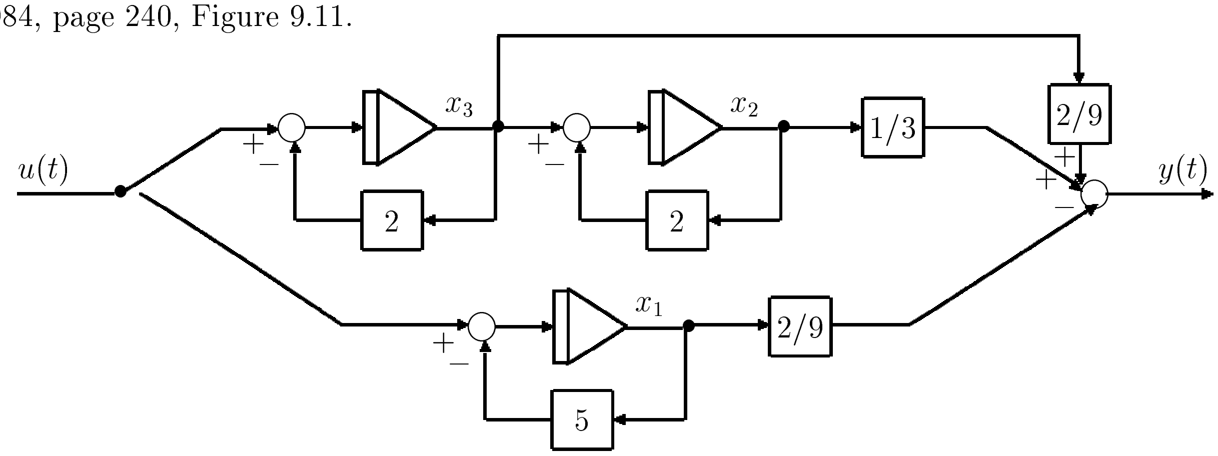


Fig. 9.11

From Fig. 9.11,

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} -5 & 0 & 0 \\ 0 & -2 & 1 \\ 0 & 0 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} u \quad \text{and} \quad y = [-2/9\ 1/3\ 2/9]x$$

Benchmark 5:

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

Proof: Define the function $G : A \subset R^n \times R^m \to R^n \times R^m$ by $G(x, y) = (x, F(x, y))$. Since F is of class C^p, and the identity mapping is of class C^∞, 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:

Allen F. Henry, *Nuclear Reactor Analysis*, MIT Press, Cambridge, Mass, 21982, page 495, equation 11.4.19, subequations 4 and 5.

$$iB_r\left[\tilde{a}^n_{kl}\right] \equiv \frac{1}{2}(h_{n-1} + h_n) \int_0^R 2\pi r\ dr \left[\rho^{n_*}_k(r)\right] \frac{d}{dr} \left[\Psi^n_l(r)\right],$$

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

Benchmark 7:

$\cdots\cdots\cdots\cdots$ iΔ

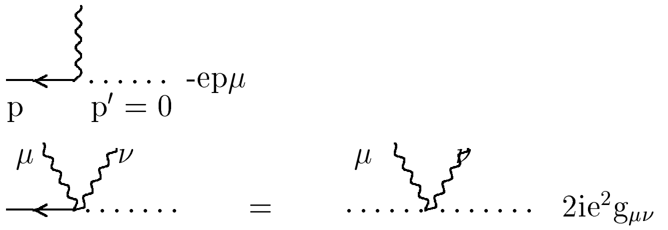
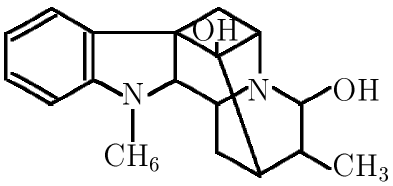


FIG. 13. Feynman rules for the ϕ_c scalars.

Benchmark 8:



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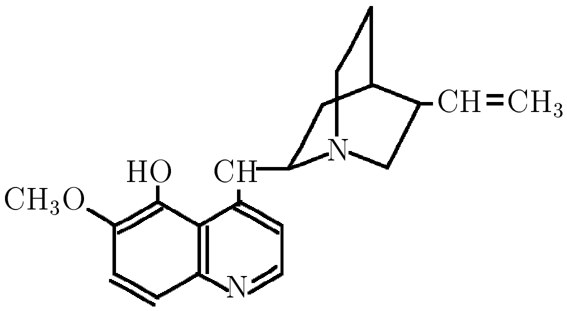

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Benchmark 9:

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