19 [7].—JEFFREY SHALLIT, *Calculation of $\sqrt{5}$ and ϕ (the Golden Ratio) to* 10,000 *Decimal Places*, ms. of 12 typewritten sheets deposited in the UMT file.

In a two-page introduction the author briefly describes his method of calculating these related numbers to 10015D on an IBM 360/75 system. He states that he successfully compared the first 4599D of his approximation to ϕ with the value given to that precision by Berg [1].

Following the tabulation of $\sqrt{5}$ and ϕ to 10000D, there appear tables of the frequency distribution of the decimal digits in each number.

As a further check on this calculation, this reviewer has successfully compared the present approximation to $\sqrt{5}$ with more extended, unpublished values of Jones [2] and of Beyer, Metropolis and Neergaard [3], which were carried to 22900D and 24576D, respectively.

J. W. W.

1. MURRAY BERG, "Phi, the golden ratio (to 4599 decimal places) and Fibonacci numbers," *Fibonacci Quart.*, v. 4, 1966, pp. 157–162.

2. M. F. JONES, 22900D *Approximations to the Square Roots of the Primes less than* 100, reviewed in *Math. Comp.*, v. 22, 1968, pp. 234–235, UMT 22.

3. W. A. BEYER, N. METROPOLIS & J. R. NEERGAARD, *Square Roots of Integers* 2 *to* 15 *in Various Bases* 2 *to* 10: 88062 *Binary Digits or Equivalent*, reviewed in *Math. Comp.*, v. 23, 1969, p. 679, UMT 45.

20 [9].—P. BARRUCAND, H. C. WILLIAMS & L. BANIUK, *Table of Pure Cubic Fields $Q(\sqrt[3]{D})$ for $D < 10^4$*, University of Manitoba, 1974, 133 pages computer output deposited in the UMT file.

There are 8122 distinct pure cubic fields $Q(\sqrt[3]{D})$ for $1 < D < 10^4$. They are listed here in order of D, not in order of their discriminants $-3k^2$. For the calculation of k, see the paper [1] in this issue for which this table was computed. There are listed here D; k; J, the period length of Voronoi's algorithm for computing the fundamental unit; R, the regulator to 10S; h, the class number; and $\Phi(1) = 2\pi hR/\sqrt{3}\,k$, Artin's function, to 10D.

Concerning Tables 1–5 in [1], the following comments may be of interest. In Table 1, for every natural number $n < 53$, there is at least one D for which $n|h$. But there are none here for $n = 53, 55, 59, \ldots$. In analogy with the results of Yamamoto [2] and Weinberger [3] for real quadratic fields, it is reasonable to conjecture that every n will be a divisor as $D \longrightarrow \infty$. One finds no less than 142 D here with $81|h$, but since the class groups are not computed in [1], nor even the 3-rank r_1 (see Section 7), it is left open whether $r_1 = 4$ or 5 occurs for $D < 10^4$.

Table 2 shows that the density of D with $h = 1$ declines as D increases. Of course, the density must $\longrightarrow 0$ since almost all D will have $3|h$ (and even $3^n|h$) as $D \longrightarrow \infty$. But if one restricts D to the primes $q \equiv 2 \pmod 3$, then $3 \nmid h$, and it is reasonable to ask if the number of $Q(\sqrt[3]{q})$ having $h = 1$ has an asymptotic density as $q \longrightarrow \infty$. That is plausible. I find that 294 of the 617q here have $h = 1$ and the density remains close to 48%. It would be of interest to extend the table of such $Q(\sqrt[3]{q})$ having $h = 1$ for $q > 10^4$ to study this further. Since the Euler product method (see Section 5) should be able to distinguish $h = 1$ and $h \geqslant 2$ with a modest value of Q, this extension could be done very efficiently.

Tables 3 and 4 are analogous to the *lochamps* and *hichamps* of [4] for quadratic fields. Note that all D in Table 3 are $\equiv \pm 2, \pm 4$, or $\pm 6 \pmod{18}$. That guarantees that 2 and 3 ramify completely and thereby contribute the minimal factor 1 to $\Phi(1)$. In Table 4 all $D > 29$ are $\equiv \pm 1 \pmod{18}$, and now 2 and 3 contribute the maximal factor