To the Editor
The Computer Journal

Sir,

Comments on papers by Maddison and Westreich

The papers by Maddison (1980) and Westreich (1980) in the May 1980 issue of *The Computer Journal* deserve some critical comments.

Maddison assumes that the probabilities of finding a free location at each probe are independent, which is an optimistic approximation. The analysis and simulation results in Brent (1973) show that (for a related method) the expected number of probes to access an item is greater than the assumption of independence would lead us to anticipate. Thus, the results of simulations should have been presented to support the validity of Maddison's claims.

Maddison also makes the (unstated) assumption that when inserting a key, we know in advance that it is not already in the table. This assumption is invalid in the common situation where, given a key, we want to look it up and insert it only if it is not found. Without the assumption we have to scan along the chain corresponding to the given key before trying to insert it by Maddison's breadth-first search algorithm, increasing the expected number of probes required to insert a key.

Thus, Maddison's comparison of his proposed algorithm with those of Brent (1973) and Malloch (1977) is inconclusive. A much more thorough and convincing analysis of the breadth-first search algorithm (including simulation results) has been given recently by Gonnet and Munro (1979).

Westreich (1980) writes

$$F(z) = P(z)/z^k = Q(z) + R(z),$$

where $P(z)$ is a polynomial of degree n, $k \simeq n/2$, $Q(z)$ is a polynomial of degree $n - k$, and $R(1/z)$ is a polynomial of degree k. He claims that 'instead of evaluating $P(z_0)$ we evaluate $Q(z_0)$ and $R(z_0)$ where in each case the round off error will be considerably less than for $P(z_0)$'. The method of evaluation is not specified, but if Horner's rule is used it is easy to see that the computed value of $Q(z_0) + R(z_0)$ will be the exact value of $\tilde{Q}(z_0) + \tilde{R}(z_0)$, where $\tilde{Q}(z)$ and $\tilde{R}(1/z)$ are the same polynomials as $Q(z)$ and $R(1/z)$ except that their coefficients $\tilde{q}_i$ and $\tilde{r}_i$ have suffered slight perturbations (in fact

$$|\tilde{q}_i - q_i| = O(n\epsilon\, |q_i|)$$

if ϵ is the machine precision). But the same is true if we simply evaluate $P(z_0)$ and then divide by z_0^k (Wilkinson, 1963)! Westreich does not give any convincing theoretical or empirical evidence that his method is more accurate than the obvious one. Whether Westreich's suggestion is used or not, the only difficult decision is whether $P(z_0)$ (or $F(z_0)$) is 'sufficiently near zero' or not, but Westreich does not give any criterion for making this decision.

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Yours faithfully,

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