is minimized by the choice $c = c^*$. A design which minizes $d(x_0)$ can then be obtained easily from c^* in a manner described in [8]; for our present considerations, we need only mention that $d(x_0) = [m(c^*)]^{-2}$, which can be used to tell us whether or not $x_0 \varepsilon B$.

Finally, we remark that the Chebyshev approximation problem just described in terms of the g_i's can be rewritten as a "modified Chebyshev problem" in terms of the original f_i's, namely, to minimize

$$\max_x |[1 + \sum_2^k c_i f_i(x_0)] f_1(x)/f_1(x_0) - \sum_2^k c_i f_i(x)|.$$

For computational purposes, it is often convenient to solve this problem by first solving the restricted Chebyshev problem of minimizing

$$\max_x |f_1(x)/f_1(x_0) - r^{-1} \sum_2^k c_i f_i(x)|$$

subject to $\sum_2^k c_i f_i(x_0) = r - 1$, then multiplying the resulting minimum by r and minimizing with respect to r.

REFERENCES

[1] CHERNOFF, H. (1953). Locally optimum designs for estimating parameters. *Ann. Math. Statist.* **24** 586–602.

[2] EHRENFELD, S. (1955). Complete class theorems in experimental designs. *Proc. Third Berkeley Symp. Math. Stat. Prob.* **1** 57–67. Univ. of California Press.

[3] ELFVING, G. (1952). Optimum allocation in linear regression theory. *Ann. Math. Statist.* **23** 225–262.

[4] KIEFER, J. (1958). On the nonrandomized optimality and randomized nonoptimality of symmetrical designs. *Ann. Math. Statist.* **29** 675–699.

[5] KIEFER, J. (1959). Optimum experimental designs. *J. Roy. Statist. Soc., Ser. B* **21** 272–319.

[6] KIEFER, J. (1961). Optimum designs in regression problems, II. *Ann. Math. Statist.* **32** 298–325.

[7] KIEFER, J. (1961). Optimum experimental designs, V, with applications to rotatable and systematic designs. *Proc. Fourth Berkeley Symp. Math. Stat. Prob.* **1** 381–405. Univ. of California Press.

[8] KIEFER J. and WOLFOWITZ, J. (1959). Optimum designs in regression problems. *Ann. Math. Statist.* **30** 271–294.

[9] KIEFER J. and WOLFOWITZ, J. (1960). The equivalence of two extremum problems. *Can. J. Math.* **12** 363–366.

A CONTOUR-INTEGRAL DERIVATION OF THE NON-CENTRAL CHI-SQUARE DISTRIBUTION

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The brief discussion which follows presents a contour-integral derivation of the non-central chi-square distribution. Although this distribution is well

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