ALGORITHM 55
COMPLETE ELLIPTIC INTEGRAL OF THE FIRST KIND
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real procedure ELLIPTIC 1(k); value k; real k;
comment This procedure computes the elliptic integral of the
first kind K(k, π/2);
begin
  real t;
  t := 1 - k × k;
  ELLIPTIC 1 := ((0.032024666 × t +
                  0.054535300) × t
                  + 0.067322813) × t + 1.3862944)
    − ((0.018994412 × t + 0.09018519) × t
    + 0.12475074) × t + 0.5) × log (t)
end
ELLIPTIC 1;

CERTIFICATION OF ALGORITHM 55

and

CERTIFICATION OF ALGORITHM 149

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The bodies of Algorithm 55 and of the second procedure of
Algorithm 149 were tested on the LGP-30 computer using SCAVP,
the Dartmouth “load-and-go” translator for a substantial sub-
set of ALGOL 60. The floating-point arithmetic for this translator
carries 7+ significant digits.

In addition to modifications required because of the limitations
of the SCAVP subset, the following need correction:

In Algorithm 55:
1. The constant 0.054555509 should be 0.054544409.
2. The function log should be ln.

In procedure ELIP 2 of Algorithm 149, the statement a := c
should be a := C.

The parameters of Algorithm 149 are related to the complete
elliptic integral of the first kind by: K = a×ELIP(a, b) where
the parameter m = k² = 1 - b/a.

The maximum approximation error in Algorithm 55 is given by
Hastings as about 0.60×6. In addition there is the possibility of
serious cancellation error in forming the complementary param-
eter t = 1 - k × k. For k near 1, errors as great as 4 significant
digits were sustained. In these regions, the complementary param-
eter itself is a far more satisfactory parameter.

The accuracy obtainable with Algorithm 149 is limited only by
the arithmetic accuracy and the amount of effort which it is
desired to expend. Six-figure accuracy was obtained with 5 appli-
cations of the arithmetic-geometric mean for a = 1000, b = 2,
and with one application for a = 500, b = 500.