CODES FOR CHAPTER 8

MCintegral.f90

MCintegral is a little program that evaluates the integral $\int_a^b f(x)\,dx$ for any specified function by the Monte Carlo method, as outlined in equation (8.10).

Input:

F(x)	=	The function to be integrated
a	=	Lower limit of integration
b	=	Upper limit of integration
varmax	=	Maximum relative standard deviation allowed

Output:

no. of bundles	=	Number of statistical samples taken (with a minimum of 10000 built in)
integral	=	Best estimate of the value of the desired integral
std dev	=	Absolute standard deviation for the result
rel.err(%)	=	Estimated relative error (in %), based on one standard deviation.

The number of statistical bundles is broken up into numsmpls realizations of N samples each. Using these different realizations, variances are calculated according to equation (8.8), and the relative variance is compared to stddevmax; if it exceeds it the number of bundles is doubled, the numsmpls realizations are compacted into half that many, and numsmpls/2 new realizations (with twice as many samples) are generated (giving numsmpls realizations with twice as many samples as before), etc., until the convergence criterion is met. For example, F(x)=sin(x), a=0., b=pi/2., and varmax=0.002 results in (the correct answer being 1):

```
no. of bundles    integral    std dev   rel.err(%)
        10000   1.0024E+00  4.8714E-03   0.49
        20000   9.9957E-01  2.8855E-03   0.29
        40000   1.0001E+00  1.4426E-03   0.14
```