

Blog Entry © Wednesday, May 13, 2026, by James Pate Williams, Jr. Adaptive n-Quadrature Versus Monte Carlo Integration

Online References: [An adaptive algorithm for numerical integration over an n-dimensional cube - ScienceDirect](#) and [cos302 f20 lecture19 monte.pdf](#)

Back in 2015 I translated the adaptive algorithm from the FORTRAN (Formula Translator) in the first reference to C#. Later in May 2026, I translated the C# source code to C++, and I added Monte Carlo integration. The C# and C++ integral results were the same.

In the following tables number is the function evaluation count. We use 50,000,000 function evaluations for each of the eight multidimensional Monte Carlo integrals. The adaptive integration has a much better runtime than Monte Carlo integration.

N-Quadrature Table Dialog



desired relative error 0.001

f#	integral	epsilon	number	err code
1	+1.4346639496e+00	1.2951159711e-03	257	0
2	+5.7531639665e-01	5.7454698861e-04	97	0
3	+2.1527578485e+00	1.7934287621e-03	45	0
4	+1.5998921741e+01	1.5798024767e-02	151	0
5	+1.8390615688e-01	6.5109672408e-05	97	0
6	-4.0003324629e+00	3.7479705194e-03	17	0
7	+8.6330831791e-01	8.5636829332e-04	45	0
8	+4.1888246736e+00	2.8744650355e-03	45	0

f#	abs error	percent error
1	+9.7938837210e-05	+6.8261387483e-03
2	+4.7748257754e-05	+8.2987892410e-03
3	+6.1501589893e-04	+2.8576909005e-02
4	+1.0782593204e-03	+6.7391207526e-03
5	+9.9602348685e-07	+5.4159040098e-04
6	+3.3246288154e-04	+8.3115720386e-03
7	+2.6210055455e-04	+3.0369237392e-02
8	+3.4468822215e-05	+8.2288251571e-04

Monte Carlo Integrals

f#	integral	abs error	percent error
1	+1.4347782877e+00	+1.6399322906e-05	+1.1429996182e-03
2	+5.7513873302e-01	+2.2541188423e-04	+3.9177256043e-02
3	+2.1521757478e+00	+3.2915192524e-05	+1.5294148709e-03
4	+1.5988597593e+01	+1.1402407400e-02	+7.1265046250e-02
5	+1.8389383816e-01	+1.3314743113e-05	+7.2399267254e-03
6	-4.0165801491e+00	+1.6580149097e-02	+4.1450372743e-01
7	+8.6100165582e-01	+2.0445615356e-03	+2.3690058475e-01
8	+4.1884004912e+00	+3.8971354532e-04	+9.3037255691e-03

Runtime in seconds = 24.000