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Lab 8

Data Analysis

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In this lab the goal was integrate three functions…

$$\int_0^1 \frac{1}{x^2+1}\,dx \qquad \int_1^2 x^{-1}\,dx \qquad \int_0^2 2^x\,dx$$

Using three numerical methods; Trapezoidal Rule, Richardson's Extrapolation (on Trapezoid Approximations), and Simpson's Rule. The written C++ program has methods that iterate over the functions from 0/1 to the number provided by the user. In the output below a max of 8 iterations is used on each function in the order given.

i = iteration, X[i]=Approximation for i iterations, EX[i] = |Analytical Sol – Appr|

Iterations: 8   Subintervals: 2^i

i	T[i]	ET[i]	R[i]	ER[i]	S[i]	ES[i]
0	0.416666666666667	0.018543209016887				
1	0.430555555555556	0.004654320127998	0.435185185185185	0.000024690498369	0.435185185185185	0.000024690498369
2	0.434050874599655	0.001159001083899	0.435218033998522	0.000008158314968	0.435215980947688	0.000006105264134
3	0.434920423572079	0.000289452111475	0.435209763488289	0.000000112195265	0.435210273229554	0.000000397546000
4	0.435137531444505	0.000072344239050	0.435209876075289	0.000000000391735	0.435209900735313	0.000000025051759
5	0.435191790800403	0.000018084883151	0.435209875683224	0.000000000000330	0.435209877252369	0.000000001568815
6	0.435205354536338	0.000004521147216	0.435209875683551	0.000000000000003	0.435209875781650	0.000000000098096
7	0.435208745401347	0.000001130282207	0.435209875683551	0.000000000000003	0.435209875689684	0.000000000006130
8	0.435209593113288	0.000000282570266	0.435209875683552	0.000000000000002	0.435209875683935	0.000000000000381

i	T[i]	ET[i]	R[i]	ER[i]	S[i]	ES[i]
0	0.750000000000000	0.056852194400550				
1	0.708333333333333	0.015185527733883	0.694444444444444	0.001296638844994	0.694444444444444	0.001296638844994
2	0.697023809523809	0.003876003924359	0.693174603174603	0.000026797575153	0.693253968253968	0.000106162654518
3	0.694121850371850	0.000974044772400	0.693147477644832	0.000000327954618	0.693154530654531	0.000006725055081
4	0.693391202207527	0.000243396608077	0.693147181916745	0.000000623682705	0.693147652819419	0.000000152780031
5	0.693208208269249	0.000060402669799	0.693147180562297	0.000000625037153	0.693147210289823	0.000000595309627
6	0.693162438883403	0.000014633283953	0.693147180559947	0.000000625039503	0.693147182421455	0.000000623177995
7	0.693150995228108	0.000003189628658	0.693147180559945	0.000000625039505	0.693147180676343	0.000000624923107
8	0.693148134232443	0.000000328632993	0.693147180559946	0.000000625039504	0.693147180567221	0.000000625032229

i	T[i]	ET[i]	R[i]	ER[i]	S[i]	ES[i]
0	5.000000000000000	0.671914877333110				
1	4.500000000000000	0.171914877333110	4.333333333333330	0.005248210666443	4.333333333333330	0.005248210666443
2	4.371320307254790	0.043235184587902	4.328099992540140	0.000014869873258	4.328427076339720	0.000341953672832
3	4.338910102844230	0.010824980177349	4.328085110511300	0.000000012155581	4.328106701374050	0.000021578707164
4	4.330792397260660	0.002707274593776	4.328085145380090	0.000000022713209	4.328086495399470	0.000001372732585
5	4.328761987388130	0.000676864721244	4.328085095614910	0.000000027051976	4.328085184097290	0.000000061430400
6	4.328254390507930	0.000169267841047	4.328085194061590	0.000000071394700	4.328085191547870	0.000000068880981
7	4.328127460554240	0.000042337887352	4.328085146893730	0.000000024226846	4.328085150569670	0.000000027902788
8	4.328095712698990	0.000010590032106	4.328085128313510	0.000000005646624	4.328085130080580	0.000000007413691

List of items learned

- Trapezoidal Rule
- Richardson's Extrapolation
- Simpson's Rule
- C++ practice
- Calculating absolute error practice