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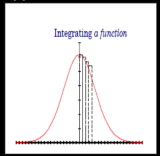
Analysis and documentation of practice 5A: Numerical integration with Simpsons rule and the t distribution November 14, 2022

1.1 Objectives Calculation of the numerical integration applying Simpsons rule, together with the T distribution, checking the results with the tests suggested in the issues located in the Hampty5A repository in github.

Numerical integration with Simpsons rule

Numerical integration is the process of determining the area under some function. Numerical integration calculates this area by dividing it into vertical strips and summing their individual areas. The key is to minimize the error in this approximation.



Simpsons rule
1. num$_s eg$ = *initialnumberofsegments*, *anevennumber*
2. W = x/num$_s eg$, *thesegmentwidth*
3. E = the acceptable error, e.g., 0.00001
4. Compute the integral value with the following equation.
5. Compute the integral value again, but this time with num$_s eg$ = *num*$_s eg * 2$.
6. If the difference between these two results is greater than E, double num$_s egandcomputetheintegralvalueagain.Continuedoingthisuntil$
the difference between the last two results is less than E. The latest result is the answer. TEST
Should return p=16 if f(x)=2x, x0=0, x1=4, num$_s eg$ = 4, *dof* = 0
Should return p=0.33333 if f(x)= x*x, x0=0, x1=1, num$_s eg$ = 4, *dof* = 0
Should return p=1.386 if f(x)= 1/x, x0=1, x1=4, num$_s eg$ = 6, *dof* = 0

T distribution

The t distribution
The t distribution is a very important statistical tool. It is used instead of the normal distribution when the true value of the population variance is not known and must be estimated from a sample.
The shape of the t distribution is dependent on the number of points in your dataset. As n gets large, the t distribution approaches the normal distribution. For lower values, it has a lower central hump and fatter tails.
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Some introduction of the list. Test
1. First well set $\text{num}_s eg = 10(anyevennumber)$
2. W = x/$\text{num}_s eg = 1.1/10 = 0.11(anyevennumber)$
3. E = 0.00001 (any even number)
4. dof = 9 (any even number)
5. x = 1.1 (any even number)
6. Compute the integral value with the following equation.
7. We can solve the first part of the equation:
Compute the integral value again, but this time with $\text{num}_s eg = 20$. *The* new result is 0.35005864.
8. We compare the new result to the old result.
9. 0.35005890.35005864 < E
10. We can then return the value p =0.35005864.
TEST
Should return P=0.35006 if f(x)x0=0, x1=1.1, $\text{num}_s eg = 10, dof = 9$
Should return P=0.33333 if f(x)x0=0, x1=1.1812, $\text{num}_s eg = 10, dof = 10$
Should return p=1.386 if f(x)x0=0, x1=2.750, $\text{num}_s eg = 10, dof = 30$