Laboratorijske vaje Numerične metode

11. Vaja

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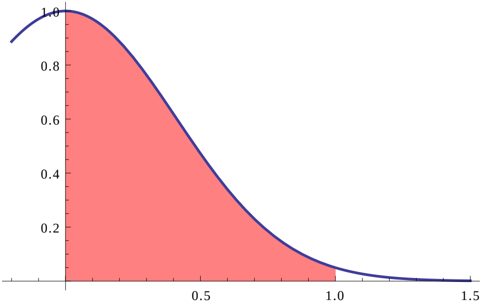
Izračunaj priblizno vrednost integrala $\int_0^1 e^{-3x^2}\,dx$.

Interval $[0, 1]$ razdeli na $n = 10$ enakih podintervalov in s pomočjo nalednjih formul izračunaj približno vrednost integrala. Točna vrednost integrala na 16 decilmanih mest je 0.5043435602314388.



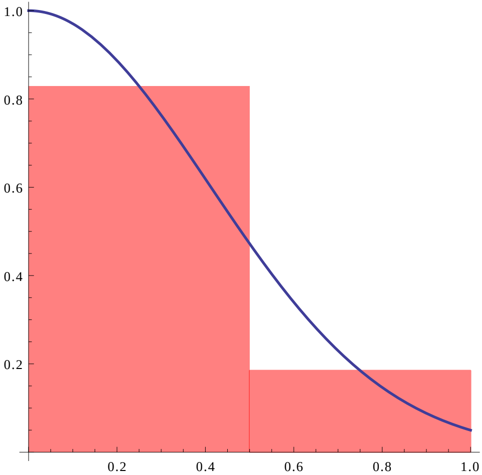
Srednja vrednost

$$\int_a^b f(x)\,dx = h\sum_{i=1}^{n} w_i f(x_i) + \frac{(b-a)h^2}{24} f''(\xi),$$

$w_i = 1,\ h = \frac{b-a}{n},\ x_i = a - \frac{h}{2} + i\,h,\ i = 1,\ldots,n$ in $\xi \in [a,b]$.

```
f=inline('exp(-3*x.^2)','x');
a=0; b=1; n=10; h=(b-a)/n;
x=linspace(a+h/2,b-h/2,n);
y=f(x);
w=ones(size(x));
M=h*dot(y,w);
```

Slika 1



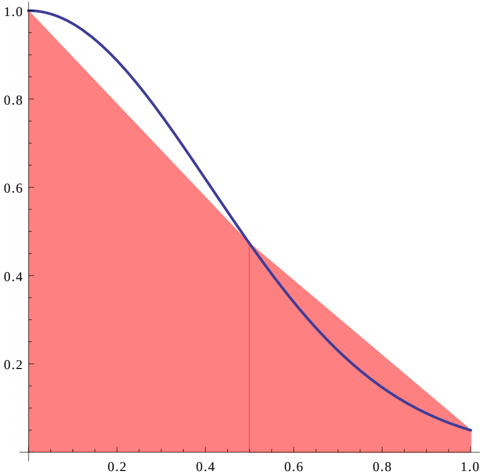
Trapezna matoda

$$\int_a^b f(x)\,dx = \frac{h}{2}\sum_{i=0}^{n} w_i f(x_i) - \frac{(b-a)h^2}{12} f''(\xi),$$

$w_0 = w_n = 1,\ w_i = 2,\ i = 1, \ldots, n-1,$
$h = \frac{b-a}{n},\ x_i = a + i\,h,\ i = 0, \ldots n$ in $\xi \in [a, b]$.

```
x=linspace(a,b,n+1);
y=f(x);
w=[1,2*ones(1,n-1),1];
T=h/2*dot(y,w);
```

Slika 2



Simpsonova metoda

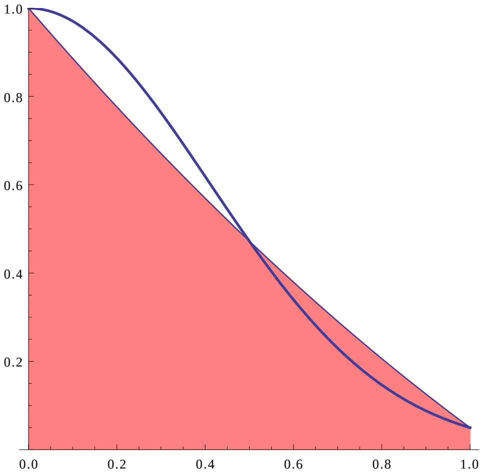
$$\int_a^b f(x)\,dx = \frac{h}{3}\sum_{i=0}^{n} w_i f(x_i) + \frac{(b-a)h^4}{180} f^{(4)}(\xi),$$

$w_0 = w_n = 1,\ w_i = 4 - \left(1 + (-1)^i\right),\ i = 1, \ldots, n-1,\ h = \frac{b-a}{n},$
$x_i = a + i\,h,\ i = 0, \ldots, n,\ n = 2m+1,\ m \in \mathbb{N}$ in $\xi \in [a, b]$.

```
w=[1,(4-(1+(-1).^(1:n-1))),1];
S=h/3*dot(y,w);
printf('M=%0.5f, T=%0.5f\n',M,T);
printf(S=%0.5f, (2*M+T)/3=%0.5f\n',S,(2*M+T)/3);
```

```
M=0.50447, T=0.50410
S=0.50434, (2*M+T)/3=0.50434
```

Slika 3



Slika 4