DIS 002

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1 Symbolic library

Code

```
% Symbolic library
% define symbolic variable
syms x
% define symbolic function
ftn = exp(1-cos(x))-1;
% use diff to take derivative
dftn = diff(ftn);
% use talyor to find the taylor expansion
tyftn = taylor(ftn, x, 'ExpansionPoint', 0, 'order', 4);

% To compute value, we need to convert sym function to function handle
% use matlabFunction
fhd = matlabFunction(ftn);
dfhd = matlabFunction(dftn);
tyfhd = matlabFunction(tyftn);

fprintf("f(0.1) = %f\n", fhd(0.1))
fprintf("f'(0.1) = %f\n", dfhd(0.1))
fprintf("T4(0.1) = %f\n", tyfhd(0.1))
```

Result

```
f(0.1) = 0.005008
f'(0.1) = 0.100333
T4(0.1) = 0.005000
```

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2 Chopping

2. The number e is defined by $e = \sum_{n=0}^{\infty}(1/n!)$, where $n! = n(n-1)\cdots 2\cdot 1$ for $n \neq 0$ and $0! = 1$. Use four-digit chopping arithmetic to compute the following approximations to e, and determine the absolute and relative errors.

a. $e \approx \sum_{n=0}^{5} \frac{1}{n!}$

b. $e \approx \sum_{j=0}^{5} \frac{1}{(5-j)!}$

Code

```
% rounding is easy
% all you need to do here is use round function in Matlab
% there is no chopping
% we need to implement it

% ex4 determine the magnitude of input
% ex4(12345) = -1
ex4 = @(x) 3 - floor(log10(x));

% ch4 chops the results using ex4
% 12345 -> 1234.5 -> 1234 -> 12340
ch4 = @(x) floor(10^ex4(x)*x)/10^ex4(x);

resa = 0.0; resb = 0.0;
ext = exp(1);
for i = 0:5
    resa = ch4(resa+ch4(1/ch4(factorial(i))));
    resb = ch4(resb+ch4(1/ch4(factorial(5-i))));
end
fprintf("resa = %f, abs. err = %f, rel. err = %f\n", resa, abs(ext-resa), abs(ext-resa)/abs(ext))
fprintf("resb = %f, abs. err = %f, rel. err = %f\n", resb, abs(ext-resb), abs(ext-resb)/abs(ext))
```

Result

```
resa = 2.715000, abs. err = 0.003282, rel. err = 0.001207
resb = 2.716000, abs. err = 0.002282, rel. err = 0.000839
```