QF 627 Programming and Computational Finance

HWS0102 : MATLAB Basics

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Q1.

<funP.m>

```
function [P]=funP(PV, r, t)
P=(r/12*PV)/(1-(1+r/12)^(-12*t));
End
```

<Pushbutton Callback in HDBLoanCalculator.m>

```
function pushbutton1_Callback(hObject, eventdata, handles)
PV=str2num(handles.edit_LoanAmount.String);
t=str2num(handles.edit_RepaymentPeriod.String);
r=str2num(handles.edit_InterestRateOfLoan.String)/100;
P=funP(PV, r, t);
handles.edit_MonthlyInstallment.String=num2str(ceil(P));
```

Q2.

<MATLAB function>

```
function Incometax(bi, mi, xi, x)
if x>xi(end)
    i=length(xi)
else
    c=find(xi>x);
    i=c(1)-1;
end

if i==0
    y=0
else
    y=bi(i)+mi(i)/100*(x-xi(i))
end
```

```
end
```

<MATLAB script>

```
>> bi=[0, 200, 550, 3350, 7950, 13950, 21150, 28750, 36550, 44550];
>> mi=[2.0, 3.5, 7.0, 11.5, 15.0, 18.0, 19.0, 19.5, 20.0, 22.0];
>> xi=[20000, 30000, 40000, 80000, 120000, 160000, 200000, 240000, 280000, 320000];
>> x=400000;
>> Incometax(bi, mi, xi, x)
```

Q3.

```
year = 2017;
o={'+','-','*','/',''};
for o1 = o
    for o2 = o
        for o3 = o
            for o4 = o
                for o5 = o
                    for o6 = o
                        for o7 = o
                            for o8 = o
                                s=['1', o1{1}, ...
                                  '2', o2{1}, ...
                                  '3', o3{1}, ...
                                  '4', o4{1}, ...
                                  '5', o5{1}, ...
                                  '6', o6{1}, ...
                                  '7', o7{1}, ...
                                  '8', o8{1}, '9'];
                                if eval(s)==year
                                  disp([s, '=', num2str(year)])
                                end
                            end
                        end
                    end
                end
            end
```

```
            end
        end
    end
end
disp('Done!')
end
```

Q4

Matlab M-file function

```
function Sudoku(s)
    c=strfind(s,'0');
    if isempty(c)
        disp(s);
    else
        i = c(1)-1;
        excluded_numbers =[];
        for j = 1:81
            if same_row(i,j-1)|| same_col(i,j-1)|| same_block(i,j-1)
                excluded_numbers = unique([excluded_numbers, s(j)]);
            end
        end
        numbers = setdiff(['123456789'], excluded_numbers);
        for m = numbers
            Sudoku([s(1:i), m, s(i+2:81)]);
        end
    end
end
function [a] = same_row(i,j)
    a = floor((i)/9)==floor((j)/9);
end
function [a] = same_col(i, j)
    a = mod(i, 9)==mod(j, 9);
end
function [a] =same_block(i, j)
    a = floor(i/27)== floor(j/27) && floor(mod(i,9)/3)==floor(mod(j,9)/3);
```

```
end
```

M-file for script

```
>> s=['390060807' '020030050' '000005096' ...
'900502400' '000000000' '003907002' ...
'810600000' '030050080' '502090043'];
>> Sudoku(s)
```

Q5

Matlab M-file for the class

```
classdef Calloption
    properties
        S0;
        K;
        T;
        r;
        sigma;
    end
    methods
        function obj=Calloption(S0, K, T, r, sigma)
            obj.S0 = S0;
            obj.K = K;
            obj.T = T;
            obj.r = r;
            obj.sigma = sigma;
        end
        function [value2]=value(obj)
            d1 = ((log(obj.S0 / obj.K) + (obj.r+ 0.5 * obj.sigma^ 2) * obj.T)/(obj.sigma* sqrt(obj.T)));
            d2 = ((log(obj.S0 / obj.K) + (obj.r-0.5 * obj.sigma^ 2) * obj.T)/(obj.sigma* sqrt(obj.T)));
            value2 = (obj.S0 * normcdf(d1, 0.0, 1.0)-obj.K* exp(-obj.r* obj.T) * normcdf(d2, 0.0, 1.0));
        end
        function [vega2]=vega(obj)
            d1 = ((log(obj.S0 / obj.K) + (obj.r+ 0.5 * obj.sigma^ 2) * obj.T)/(obj.sigma* sqrt(obj.T)));
            vega2= obj.S0* normcdf(d1, 0.0, 1.0) * sqrt(obj.T);
        end
```

```
    function [os]=imp_vol(obj, C0, sigma_est, it)
        if nargin==3
            it=100;
        elseif nargin==2
            sigma_est=0.2;
            it=100;
        end
        option = Calloption(obj.S0, obj.K, obj.T, obj.r, sigma_est);
        for i = range(it)
            option.sigma = option.sigma-(option.value()-C0) / option.vega();
            os=option.sigma;
        end
        end
    end
end
```

M-file script

```
>> a = Calloption(100, 105, 1, 0.05, 0.2)
>> a.value()
>> a.vega()
>> a.imp_vol(a.value)
```