

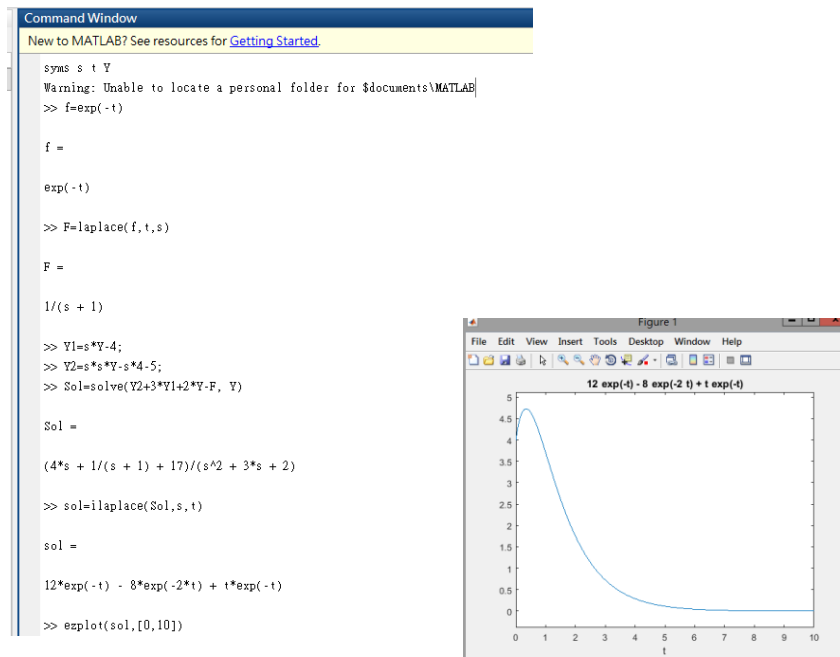
請把答案卷 word 檔案與 每一小題的 .m 檔案 (若同一題有多個 .m 檔案，請在 word 檔案上清楚標示每一個.m 檔案的對應題號)，上傳到 e-learning [matlab 期末考]上傳區

- 滿分 20 分
- 只有交 word 檔案扣總分 5 分、只有交 .m 檔案扣總分 10 分
- 請把所有檔案各別上傳到 elearning 的[matlab 期末考]上傳區，不需壓縮，不符合規則扣總分 2 分
- 答案無法下載不算分，請同學在上傳後務必自己下載下來測試
- 考試中若電腦當機不延長時間，請在開始考試前確認電腦狀況，並隨時存檔
- 可以使用自己的電腦
- 考試中，不得開啟訊息傳遞的任何 APP (手機也不能使用、Line, Facebook, IG, Teams, Telegram, Gmail, 信箱, ...)，若開啟，不論有無傳訊都扣分
- 考試時間到 21:00，e-learning 會自動關閉，來不及上傳不算分

範例: 求解 $y'' + 3y' + 2y = e^{-t}$, $y(0) = 4$ and $y'(0) = 5$ ，並做圖 $0 < x < 10$ ，
Matlab 程式碼 (若不是 function，只需輸入你 key in 的即可):

```
syms s t Y
f=exp(-t);
F=laplace(f,t,s)
Y1=s*Y-4;
Y2=s*s*Y-s*4-5;
Sol=solve(Y2+3*Y1+2*Y-F, Y)
sol=ilaplace(Sol,s,t)
ezplot(sol,[0,10])
```

螢幕截圖 (完整計算過程 與 題目要求的圖形):



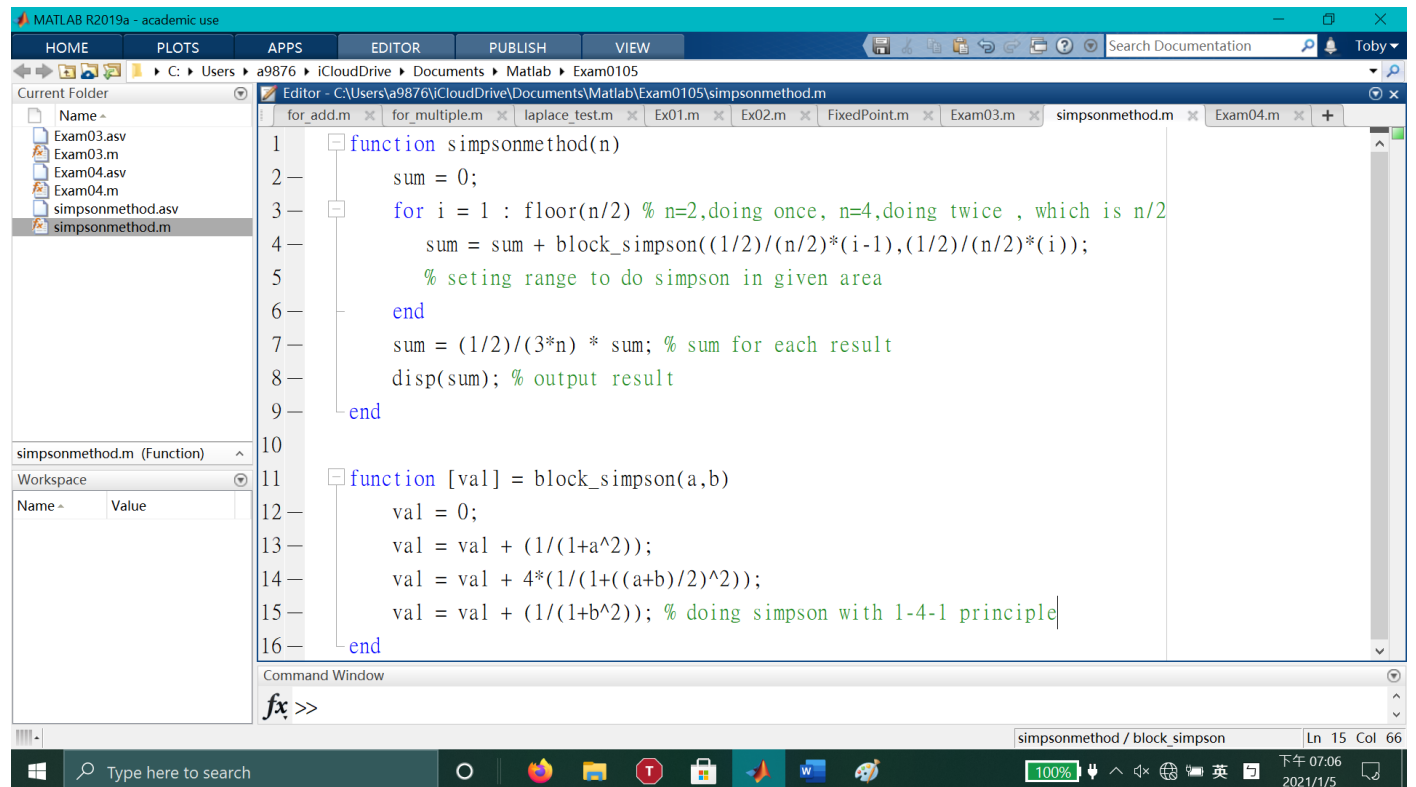
[5%] (1) 以 Simpson(辛普森法), 求 $\int_0^{\frac{1}{2}} \frac{1}{1+x^2} dx$ 之近似值,

寫一個名為 simpsonmethod 的函數, 讓使用者可以指定 n 的值,

例如: simpsonmethod(4) 代表 n=4, simpson_method(10) 代表 n=10,

請執行 n=4, n=20 的結果, 把執行的結果貼在下方

Code :



```
1 function simpsonmethod(n)
2     sum = 0;
3     for i = 1 : floor(n/2) % n=2,doing once, n=4,doing twice , which is n/2
4         sum = sum + block_simpson((1/2)/(n/2)*(i-1),(1/2)/(n/2)*(i));
5         % setting range to do simpson in given area
6     end
7     sum = (1/2)/(3*n) * sum; % sum for each result
8     disp(sum); % output result
9 end
10
11 function [val] = block_simpson(a,b)
12     val = 0;
13     val = val + (1/(1+a^2));
14     val = val + 4*(1/(1+((a+b)/2)^2));
15     val = val + (1/(1+b^2)); % doing simpson with 1-4-1 principle
16 end
```

n=4 的執行結果截圖：

MATLAB R2019a - academic use

HOME PLOTS APPS EDITOR PUBLISH VIEW

Editor - C:\Users\9876\iCloudDrive\Documents\Matlab\Exam0105\simpsonmethod.m

```

1 function simpsonmethod(n)
2     sum = 0;
3     for i = 1 : floor(n/2) % n=2,doing once, n=4,doing twice , which is n/2
4         sum = sum + block_simpson((1/2)/(n/2)*(i-1),(1/2)/(n/2)*(i));
5         % seting range to do simpson in given area
6     end
7     sum = (1/2)/(3*n) * sum; % sum for each result
8     disp(sum); % output result
9 end
10
11 function [val] = block_simpson(a,b)
12     val = 0;
13     val = val + (1/(1+a^2));

```

Workspace

Name	Value
sum	0

Command Window

```

>> simpsonmethod(4)
0.4637
fx >>

```

Type here to search

100% 下午 07:06 2021/1/5

n=20 的執行結果截圖：

MATLAB R2019a - academic use

HOME PLOTS APPS EDITOR PUBLISH VIEW

Editor - C:\Users\9876\iCloudDrive\Documents\Matlab\Exam0105\simpsonmethod.m

```

1 function simpsonmethod(n)
2     sum = 0;
3     for i = 1 : floor(n/2) % n=2,doing once, n=4,doing twice , which is n/2
4         sum = sum + block_simpson((1/2)/(n/2)*(i-1),(1/2)/(n/2)*(i));
5         % seting range to do simpson in given area
6     end
7     sum = (1/2)/(3*n) * sum; % sum for each result
8     disp(sum); % output result
9 end
10
11 function [val] = block_simpson(a,b)
12     val = 0;
13     val = val + (1/(1+a^2));

```

Workspace

Name	Value
sum	0

Command Window

```

>> simpsonmethod(20)
0.4636
fx >>

```

Type here to search

100% 下午 07:07 2021/1/5

[5%] (2) 以 Euler 法求 $y' = y+x$, $y(0)=0$ 之近似解

寫一個名為 eulermethod 的函數，讓使用者指定 n 跟 h 的值
例如， $n=5, h=0.2$

註. Euler 法：

$$y_1 = y_0 + h*f(x_0, y_0)$$

$$y_2 = y_1 + h*f(x_1, y_1)$$

$$y_3 = y_2 + h*f(x_2, y_2)$$

...

$$y_n = y_{n-1} + h*f(x_{n-1}, y_{n-1})$$

eulermethod(5,0.2) 執行結果截圖請貼在此：

The screenshot displays the MATLAB R2019a environment. The Editor window shows the function `eulermethod(n,h)` with the following code:

```
function eulermethod(n,h) % n=calculate counts h=step size
    y = 0; % y(0) = 0
    x = 0; % X0 = 0
    for i = 1 : n % doing n times
        y = y + h*(y+x); % y' = sy+x
        x = x+h; % each time let x = x + h
    end
    disp(y);
end
```

The Command Window shows the execution of `eulermethod(5,0.2)` resulting in the value `0.4883`.

[5%] (3)

$$f(x) = \begin{cases} 0 & \text{if } -\pi < x < 0 \\ \pi - x & \text{if } 0 < x < \pi \end{cases} \quad f(x + 2\pi) = f(x)$$

的傅立葉係數為:

$$a_0 = \frac{\pi}{4}$$

$$a_n = \frac{1 - \cos n\pi}{n^2\pi}$$

$$b_n = \frac{1}{n}$$

傅立葉級數為:

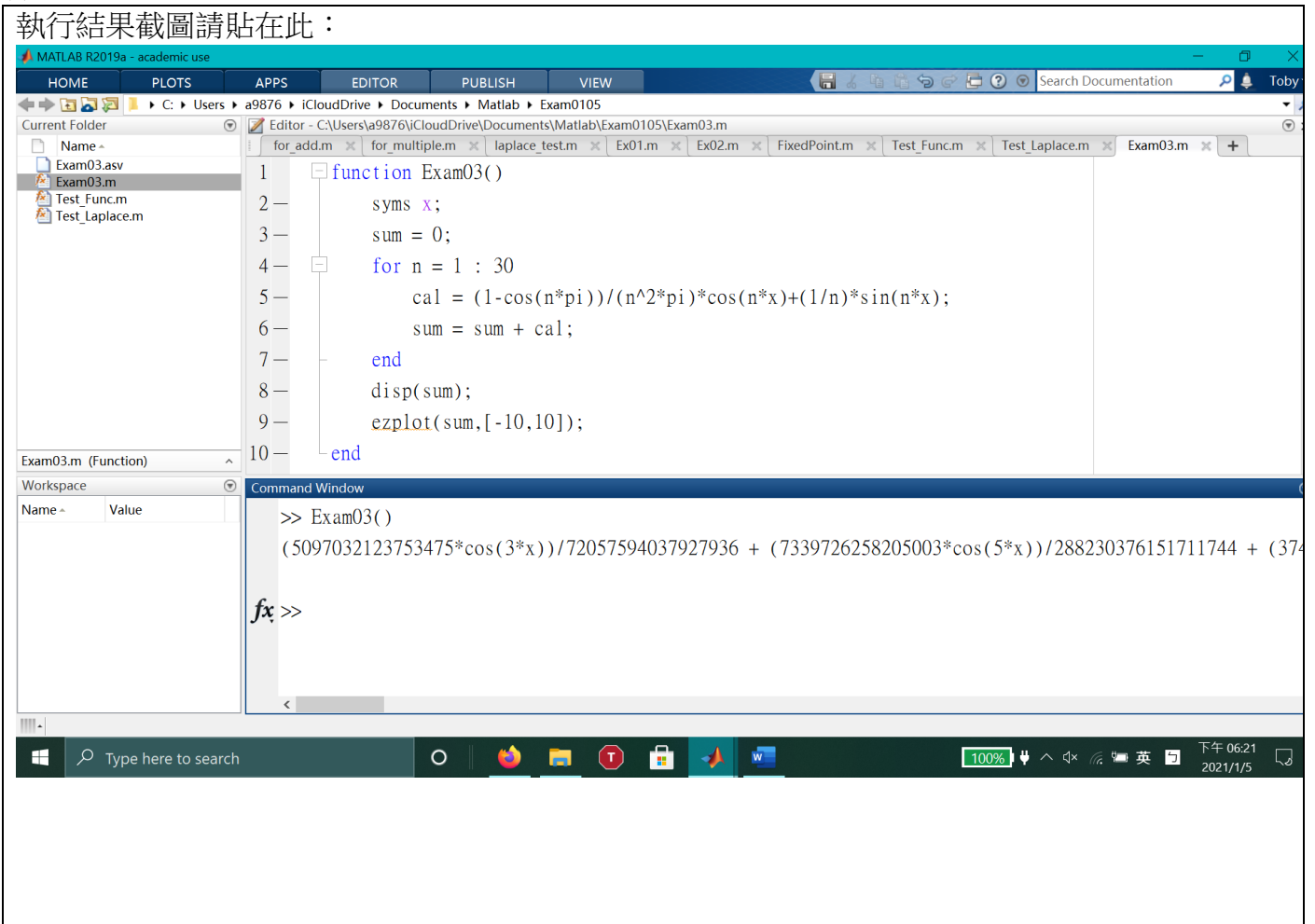
$$f(x) = \frac{\pi}{4} + \sum_{n=1}^{\infty} \left\{ \frac{1 - \cos n\pi}{n^2\pi} \cos nx + \frac{1}{n} \sin nx \right\}$$

(a) 請利用 for loop 把 $f(x)$ 的 \sum 展開，計算 S_{30} (n 從 1 到 30 的 $f(x)$ 結果) (3%)

(b) 請使用 ezplot 畫出 S_{30} 的圖形 ($-10 < x < 10$) (2%)

(a)

執行結果截圖請貼在此：



```
function Exam03()  
    syms x;  
    sum = 0;  
    for n = 1 : 30  
        cal = (1-cos(n*pi))/(n^2*pi)*cos(n*x)+(1/n)*sin(n*x);  
        sum = sum + cal;  
    end  
    disp(sum);  
    ezplot(sum,[-10,10]);  
end
```

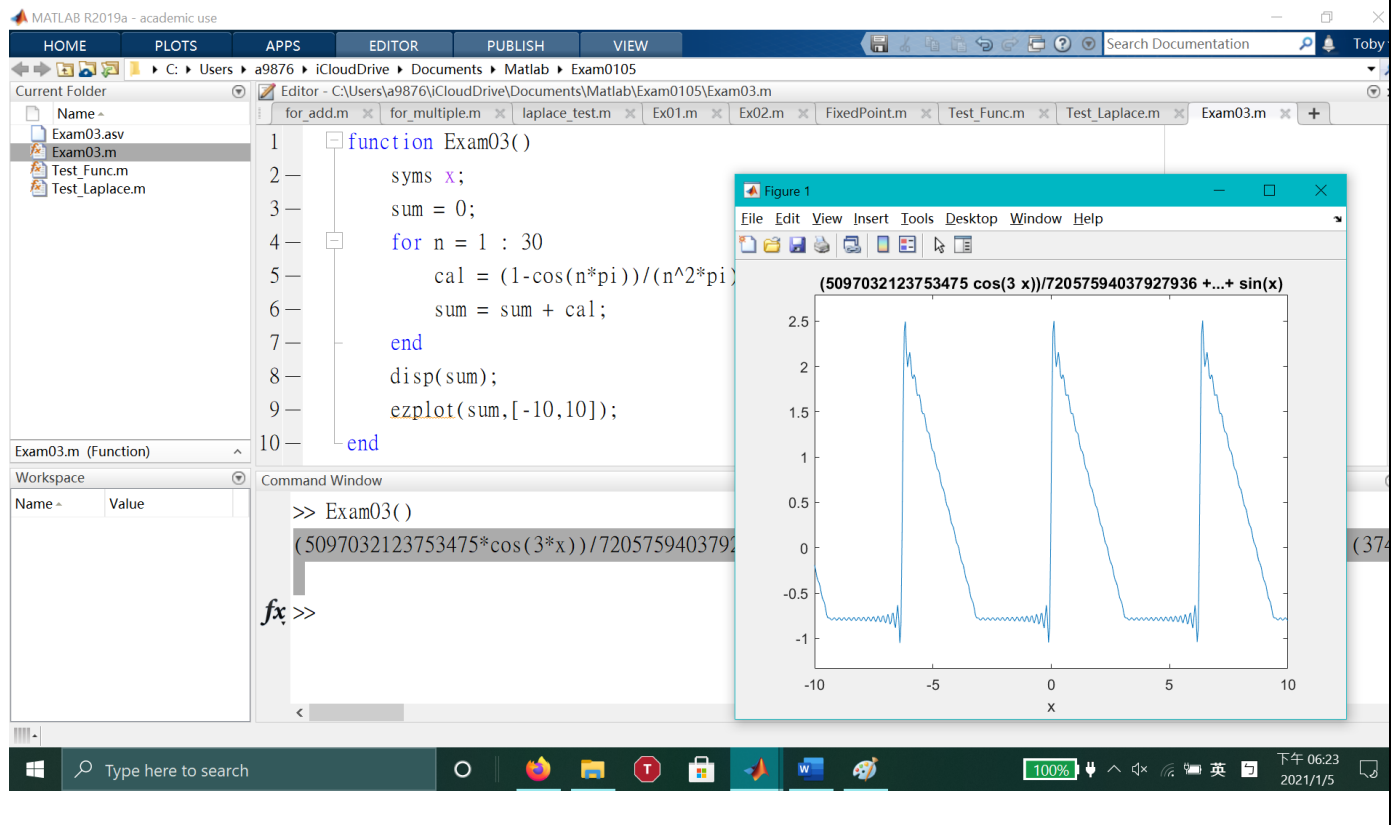
```
>> Exam03()  
(5097032123753475*cos(3*x))/72057594037927936 + (7339726258205003*cos(5*x))/288230376151711744 + (374
```

執行結果：

$$\begin{aligned} & (5097032123753475 \cdot \cos(3x)) / 72057594037927936 + (7339726258205003 \cdot \cos(5x)) / 288230376151711744 + \\ & (3744758295002553 \cdot \cos(7x)) / 288230376151711744 + (566336902639275 \cdot \cos(9x)) / 72057594037927936 + \\ & (47389761481179 \cdot \cos(11x)) / 9007199254740992 + (1085758322219675 \cdot \cos(13x)) / 288230376151711744 + \\ & (203881284950139 \cdot \cos(15x)) / 72057594037927936 + \\ & (2539697667198963 \cdot \cos(17x)) / 1152921504606846976 + \\ & (4066330336955681 \cdot \cos(19x)) / 2305843009213693952 + \\ & (3328674040002269 \cdot \cos(21x)) / 2305843009213693952 + \\ & (5549887529833651 \cdot \cos(23x)) / 4611686018427387904 + \\ & (2348712402625601 \cdot \cos(25x)) / 2305843009213693952 + (62926322515475 \cdot \cos(27x)) / 72057594037927936 \\ & + (1745475923473247 \cdot \cos(29x)) / 2305843009213693952 + \sin(2x)/2 + \sin(3x)/3 + \sin(4x)/4 + \sin(5x)/5 \\ & + \sin(6x)/6 + \sin(7x)/7 + \sin(8x)/8 + \sin(9x)/9 + \sin(10x)/10 + \sin(11x)/11 + \sin(12x)/12 + \\ & \sin(13x)/13 + \sin(14x)/14 + \sin(15x)/15 + \sin(16x)/16 + \sin(17x)/17 + \sin(18x)/18 + \sin(19x)/19 + \\ & \sin(20x)/20 + \sin(21x)/21 + \sin(22x)/22 + \sin(23x)/23 + \sin(24x)/24 + \sin(25x)/25 + \sin(26x)/26 + \\ & \sin(27x)/27 + \sin(28x)/28 + \sin(29x)/29 + \sin(30x)/30 + (5734161139222659 \cdot \cos(x)) / 9007199254740992 \\ & + \sin(x) \end{aligned}$$

(b)

執行結果截圖請貼在此：



註. (a)(b)二小題可以寫在同一個 .m 檔案

[5%] [Matlab 基礎能力測驗]

(4) 換零錢，請寫一個 MATLAB 函式，允許使用者輸入金額，在螢幕上輸出可以用幾個 10 元硬幣、五元硬幣、一元硬幣表示，以最少的硬幣數量為原則，

註, Matlab 可使用 mod() 函數找出餘數 (<https://ww2.mathworks.cn/help/matlab/ref/mod.html>)

例如：

	moneychange(88)	moneychange(9)	moneychange(90)	moneychange(61)
輸出：	10*8 5*1 1*3	10*0 5*1 1*4	10*9 5*0 1*0	10*6 5*0 1*1

請把上面四種執行結果的截圖貼在此：

(1)

The screenshot shows the MATLAB R2019a environment. The Editor window displays the function `Exam04(m)` with the following code:

```

1 function Exam04(m)
2     ten = floor(m/10);
3     m = mod(m,10);
4     five = floor(m/5);
5     m = mod(m,5);
6     one = m;
7     disp("10*" + ten);
8     disp("5*" + five);
9     disp("1*" + one);
10 end

```

The Command Window shows the execution of `>> Exam04(88)` resulting in the following output:

```

10*8
5*1
1*3
fx >>

```

The Workspace window shows the function `Exam04.m (Function)` loaded. The Command Window also shows the prompt `fx >>` at the bottom.

(2)

The screenshot shows the MATLAB R2019a - academic use interface. The top menu bar includes HOME, PLOTS, APPS, EDITOR, PUBLISH, and VIEW. The current folder is C:\Users\... \a9876 \iCloudDrive \Documents \Matlab \Exam0105. The editor window displays a function definition for Exam04.m:

```
1 function Exam04(m)
2     ten = floor(m/10);
3     m = mod(m,10);
4     five = floor(m/5);
5     m = mod(m,5);
6     one = m;
7     disp("10*" + ten);
8     disp("5*" + five);
9     disp("1*" + one);
10 end
```

The Command Window shows the execution of Exam04(9):

```
>> Exam04(9)
10*0
5*1
1*4
fx >>
```

The workspace table is empty.

(3)

The screenshot shows the MATLAB R2019a - academic use interface. The top menu bar includes HOME, PLOTS, APPS, EDITOR, PUBLISH, and VIEW. The current folder is C:\Users\... \a9876 \iCloudDrive \Documents \Matlab \Exam0105. The editor window displays a function definition for Exam04.m:

```
1 function Exam04(m)
2     ten = floor(m/10);
3     m = mod(m,10);
4     five = floor(m/5);
5     m = mod(m,5);
6     one = m;
7     disp("10*" + ten);
8     disp("5*" + five);
9     disp("1*" + one);
10 end
```

The Command Window shows the execution of Exam04(90):

```
>> Exam04(90)
10*9
5*0
1*0
fx >>
```

The workspace table is empty.

(4)

The image shows the MATLAB R2019a interface. The top menu bar includes HOME, PLOTS, APPS, EDITOR, PUBLISH, and VIEW. The current folder is C:\Users\... \Documents\Matlab\Exam0105. The editor window displays a function file named Exam04.m with the following code:

```
1 function Exam04(m)
2     ten = floor(m/10);
3     m = mod(m,10);
4     five = floor(m/5);
5     m = mod(m,5);
6     one = m;
7     disp("10*" + ten);
8     disp("5*" + five);
9     disp("1*" + one);
10 end
```

The Command Window shows the execution of the function with the input 61:

```
>> Exam04(61)
10*6
5*0
1*1
fx >>
```

The Workspace window is empty. The system tray at the bottom shows the date and time as 下午 06:39 2021/1/5.