

Midterm Exam

11/09/2016

Name:-----

Student ID:-----

Version: 777722

UC Berkeley Honor Code: "As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others."

On my honor, I have neither given nor received any assistance in the taking of this exam.

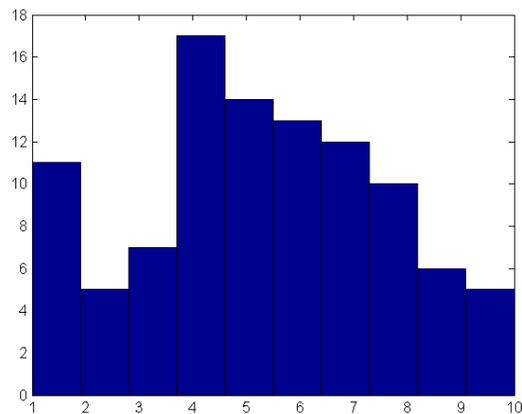
Instructions:

1. Write your full name and Student ID on the question sheet
2. Write your full name on the front of the bubble sheet
3. If your student ID number has 8 digits, start with the left box and bubble then in (leaving the right two boxes blank). If your student ID number has 10 digits, just use all boxes
4. Record your answers on the bubble sheet (use pencil). There is one correct answer for each question. Multiple bubbles, incomplete bubbles, or stray marks will be marked incorrect.
5. You may use one 8.5" by 11" cheat sheet(both sides) for this exam provided you do not disturb those sitting nearby.
6. No electronic devices are permitted in your work area.
7. There will be no questions regarding the exam during the examination time except in cases where there is a missing page or printing problem with your exam.
8. For convenience, you may separate the bubble sheet from the question sheet, return both after the exam.

1. After executing the following code, you would expect the value of B to be closest to which value?

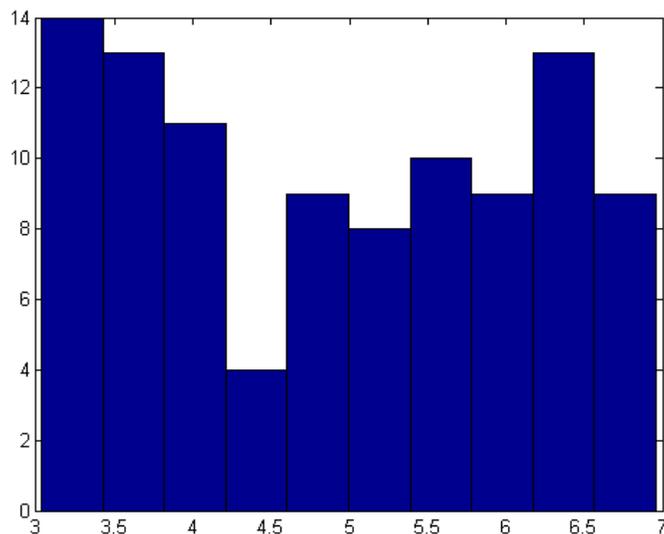
```
N = 10000;  
A = 3*randn(N,1) + 4*rand(N,1);  
B = mean(A)
```

- (a) 0
(b) 2
(c) 3
(d) 4
(e) 5
2. What is the probability density for the 5th bin from the left (centered at 5) in this histogram corresponding to 100 random integers generated between 1 and 10?



- (a) 7/50
(b) 1/10
(c) 14
(d) 1/5
(e) 1
3. The figure below was produced by which of the following lines of code?

- (a) `hist(5 + 2*randn(1000,1))`
(b) `hist(3 + 4*randi(1000,1))`
(c) `hist(3 + 4*randn(100,1))`
(d) `hist(3 + 4*rand(10000,1))`



(e) `hist(3 + 4*rand(100,1))`

4. We have an unfair coin such that the probability of it landing heads up is 0.6. We wish to write a code to simulate tossing this coin, and assign to `X` the value of `true` representing heads, and `false` representing tails. Complete the line of code below to finish this simulation.

```
p= 0.6;
U= rand;
X= -----;
```

- (a) `U+p`
 (b) `U-p`
 (c) `U<p`
 (d) `U>p`
 (e) `U==p`
5. An E7 student makes a trip to the coffee shop on 3 consecutive days to keep her study group awake. The first day she buys 2 espressos, 3 cappuccinos, and 1 latte which cost a total of \$11.50. The next day she buys 4 espressos, 1 cappuccino, and 1 latte which cost a total of \$10.50. On the third day she buys 2 espressos, 2 cappuccinos, and 2 lattes for a total of \$12. To determine the cost of each individual item (espresso, cappuccino, and latte), she writes the following partial code. Which of the following lines of code correctly fills in the missing line?

```
A = [2 3 1;
```

```
    4 1 1;  
    2 2 2];  
% MISSING LINE  
cost = A\b
```

- (a) $\mathbf{b} = [11.5; 10.5; 12];$
- (b) $\mathbf{b} = [12; 10.5; 11.5];$
- (c) $\mathbf{b} = [12, 10.5, 11.5];$
- (d) $\mathbf{b} = 11.5 + 10.5 + 12;$
- (e) $\mathbf{b} = \text{sum}(\mathbf{A});$

6. Consider the following function `myFunc`:

```
function out = myFunc(in)  
    out=in;  
    if abs(in) > 0  
        s=in/abs(in);  
        out=out+myFunc(in-s);  
    end  
end
```

What does `myFunc(-3)` return ?

- (a) -3
- (b) -4
- (c) -6
- (d) -8
- (e) -10

7. The linear system of equations below has how many exact solutions?

$$\begin{aligned}a + 2b &= 2 \\ 2a + 4b &= 4\end{aligned}$$

- (a) There are no exact solutions
- (b) 1
- (c) 2
- (d) 3
- (e) There are infinitely many exact solutions

8. What is the output of the following code?

```
X= [5; 3; 2; 5; 3; 4];  
a= median(X)
```

- (a) 3
- (b) 4
- (c) 5
- (d) 3.5
- (e) 2.5

9. After executing the following code, what is the value of s ?

```
A = [1 2 3 4; 5 4 3 2];  
B = (A') * A;  
s = size(B)
```

- (a) [2 2]
- (b) [4 4]
- (c) [4 2]
- (d) [2 4]
- (e) [8 1]

10. What is the value of n after executing the following code?

```
clear;  
n=0;  
N=[2 3 4];  
for i=[1:length(N), N]  
n=n+i;  
end  
disp(n);
```

- (a) 3
- (b) 4
- (c) 9
- (d) 15
- (e) 16

11. In Matlab we sometimes use `randn` to generate random numbers that follow normal distribution (or Gaussian distribution that has a bell-shaped curve). A student uses the following code to get a series of sample random numbers. What is the corresponding mean μ and standard deviation σ of this random variable?

```
a=(randn(1,100)+10)*2;
```

- (a) $\mu = 10, \sigma = 2$
- (b) $\mu = 10, \sigma = \sqrt{2}$
- (c) $\mu = 20, \sigma = 2$
- (d) $\mu = 20, \sigma = \sqrt{2}$
- (e) $\mu = 10\sqrt{2}, \sigma = \sqrt{2}$

12. The $N \times 1$ arrays \mathbf{x} and \mathbf{y} are both defined in the workspace and contain data points. The following code is entered in the command prompt.

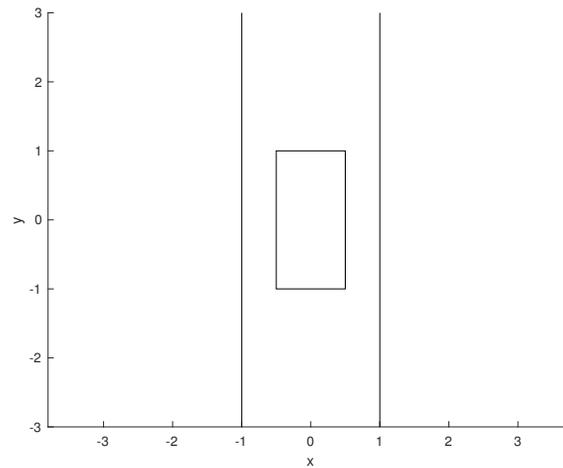
```
>>B = [x, ones(size(x)), x.^3];
>>coeff = B \ y
coeff =
    -3.19
     5.72
     2.46
```

According to Matlab, what is the equation of the best fit curve?

- (a) $y = -3.19x^3 + 5.72x + 2.46$
- (b) $y = 2.46x^3 - 3.19x + 5.72$
- (c) $y = -3.19 + 5.72x^2$
- (d) $y = 5.72x^3 - 3.19x$
- (e) $y = 2.46x$

13. A student in E7 wants to generate random points in the channel area with Matlab. The x-coordinate follows a uniform distribution in the domain $-1 < x < 1$ and the y-coordinate follows a standard normal distribution (i.e., $\mu = 0, \sigma = 1$). Recall that for a normal distribution $P(\mu - \sigma < y < \mu + \sigma) = 0.683$. Inside the channel there is a 1×2 rectangle centered at $(0, 0)$ (i.e., it ranges from -0.5 to 0.5 in x and from -1 to 1 in y). The simulation of x and y coordinates have no effect on each other (i.e., they are independent). If the student generates 10^4 points, approximately how many should he expect to be inside the rectangular region?

- (a) 5.00×10^3
- (b) 6.83×10^3
- (c) 1.83×10^3
- (d) 3.42×10^3
- (e) 2.50×10^3



14. X is a random variable generated from a normal distribution with mean 0 and variance 4. It is known that 68% of variables generated from a normal distribution lie within one standard deviation of the mean. What is the probability that $X > 2$?

- (a) 0.34
- (b) 0.17
- (c) 0.68
- (d) 0.32
- (e) 0.16

15. Consider the following function

```
function [y] = Recursivefun(a,b)
y=a+1;
if a==b
y=1;
elseif a>b
y=Recursivefun(a-1,b)+1;
elseif a<b
Recursivefun(a+1,b);
end
```

What is the value of x after the following is executed?

```
x = Recursivefun(3,7)
```

- (a) 3
- (b) 4
- (c) 5

(d) 6

(e) 7

16. After executing the code below, what shape do you expect to see on the plotting window?

```
x=linspace(-1/2,1/2,100)
y=cos(pi * x')
plot(x,y, 'xy');
```

(a) Error

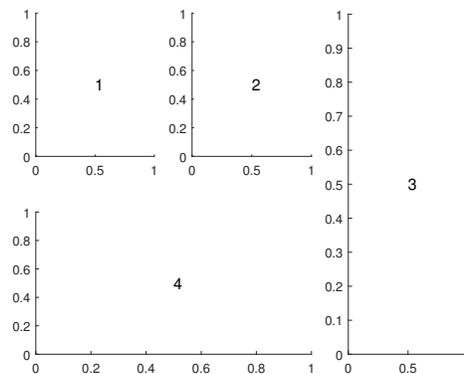
(b) A curve with yellow "x" marker at each data point

(c) A curve with "xy" marker at each data point

(d) A single point

(e) A solid-line curve

17. Which of the following `subplot` command gives you the subplot 3 (marked with number 3 in the middle)?

(a) `subplot(1,4,3);`(b) `subplot(2,3,3);`(c) `subplot(2,2,4);`(d) `subplot(2,3,[3,6]);`

(e) None of above is correct

18. Function `Recursive1` is defined below.

```
function b = Recursive1(a)
    if a == 1
        b = 2;
```

```

else
    b = a + Recursive1(a-1);
end
end

```

Which of the outputs do you expect to see if you execute the following code?

```
Recursive1(3)
```

- (a) 7
 - (b) 6
 - (c) 5
 - (d) 8
 - (e) Error: Out of memory
19. Which of the following `plot` commands does NOT give you the square shape (the square's four sides only) in the figure?

Note:

```

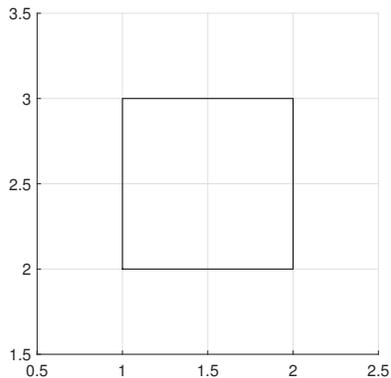
help fliplr
fliplr Flip array in left/right direction.
Y = fliplr(X) returns X with the order of elements flipped left to right
along the second dimension. For example,

```

```

X = 1 2 3      becomes  3 2 1
    4 5 6           6 5 4

```



```

N=100;
x1=ones(1,N);
x2=linspace(1,2,N);
x3=linspace(2,3,N);
axis([0.5,2.5,1.5,3.5])

```

- (a) `plot(x2, 2*x1, 2*x1, x3, x2, 3*x1, x1,x3);`
- (b) `plot(x2, 2*x1, x2, 3*x1, x1, x3, 2*x1, x3);`
- (c) `plot([2*x1,x2,x1,fliplr(x2)], [x3,2*x1,fliplr(x3),3*x1]);`
- (d) `plot([x2,2*x1,fliplr(x2),x1],[2*x1, x3,3*x1,fliplr(x3)]);`
- (e) `plot([x1,x2,2*x1,fliplr(x2)], [x3,3*x1,fliplr(x3),2*x1]);`

20. Given the following code:

```
A = zeros(2,2);
for m = 1:2
    for n = [1 2 3]
        A(m,n) = m * n;
    end
end
A(m,3) = A(m,3)-1;
```

What does `sum(A)` return?

- (a) [3 6 9]
- (b) [3 6 8]
- (c) [3 6 7]
- (d) 18
- (e) 17

21. Which of the following MatLab functions will compute y defined as follows?

$$y(n) = \log(n) + \log(n-1) + \cdots + \log(1) \quad (1)$$

- (a) `myFunc1`

```
function y=myFunc1(n)
    y = myFunc1(n-1) + log(n);
end
```

- (b) `myFunc2`

```
function y=myFunc2(n)
    if n == 1
        y = log(1);
    else
        y = log(n);
    end
end
```

(c) myFunc3

```
function y=myFunc3(n)
    if n == 1
        y = log(1);
    else
        y = myFunc3(n-1)
    end
end
```

(d) myFunc4

```
function y=myFunc4(n)
    if n == 1
        y = log(1);
    else
        y = myFunc4(n-1) + log(n);
    end
end
```

(e) myFunc5

```
function y=myFunc5(n)
    if n == 1
        y = myFunc5(1);
    else
        y = myFunc5(n-1) + log(n);
    end
end
```

22. What are the values of i and z after executing the code below?

```
i = 4;
z = 0;
while i > 0
    i = i - z;
    if i == 1
        break;
    end
    z = z + 2;
end
```

- (a) $i = 4, z = 2$
- (b) $i = 0, z = 4$
- (c) $i = 4, z = 4$
- (d) $i = -2, z = 4$
- (e) $i = -2, z = 6$