

Lektion 6 - Problems 3.14, Random Process p. 204

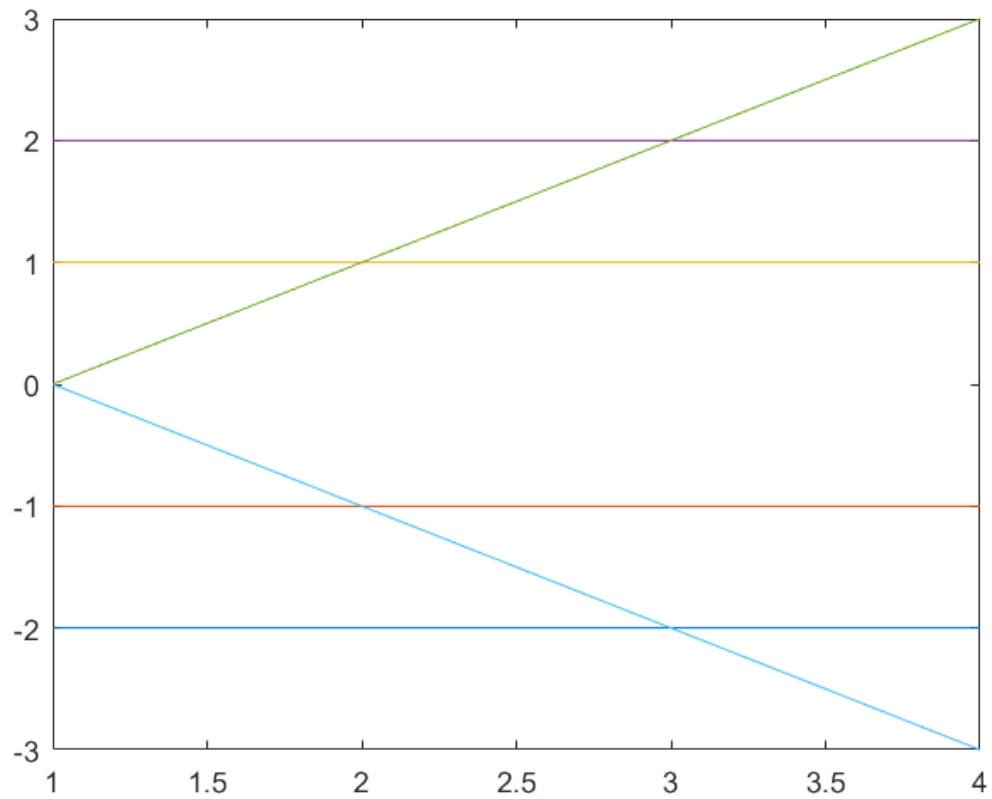
3.1 Define a random process $X(t)$ based on the outcome k of tossing a die as

$$X(t) = \begin{cases} -2 & k = 1 \\ -1 & k = 2 \\ 1 & k = 3 \\ 2 & k = 4 \\ t & k = 5 \\ -t & k = 6 \end{cases}$$

- Find the joint probability mass function of $X(0)$ and $X(2)$.
- Find the marginal probability mass functions of $X(0)$ and $X(2)$.
- Find $E\{X(0)\}$, $E\{X(2)\}$, and $E\{X(0)X(2)\}$.

a.

```
x = [0:3];  
x1 = -2; x2 = -1; x3 = 1; x4 = 2; x5 = x; x6 = -x;  
plot(ones(1,length(x)).*x1)  
hold on  
plot(ones(1,length(x)).*x2)  
hold on  
plot(ones(1,length(x)).*x3)  
hold on  
plot(ones(1,length(x)).*x4)  
hold on  
plot(x5)  
hold on  
plot(x6)  
hold off
```



OBS! $X(0) = X(1)$, $X(2) = X(3)$

- At $X(0)$ there is a line crossing at 2, 1, 0, -1 and -2
- At $X(2)$ there is a line crossing at 2, 1, -1 and -2

There is a probability of $1/6$ where the lines cross $X(0)$ and $X(2)$

$X(0) \backslash X(2)$	-2	-1	0	1	2	TOTAL
-2	$1/6$	0	$1/6$	0	0	$2/6$
-1	0	$1/6$	0	0	0	$1/6$
0	0	0	0	0	0	0
1	0	0	0	$1/6$	0	$1/6$
2	0	0	$1/6$	0	$1/6$	$2/6$
TOTAL	$1/6$	$1/6$	$2/6$	$1/6$	$1/6$	1

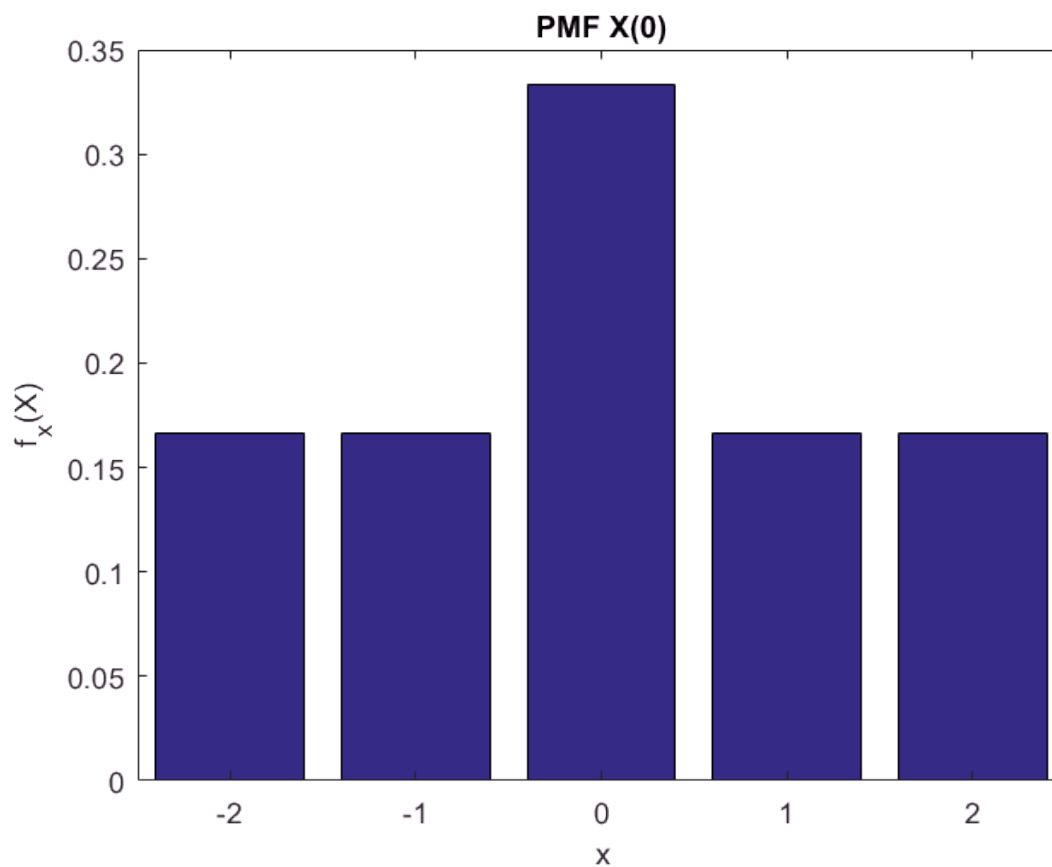
b.

Marginal pmf of $X(0)$

$X(0) \backslash X(2)$	-2	-1	0	1	2
-2	1/6	0	1/6	0	0
-1	0	1/6	0	0	0
0	0	0	0	0	0
1	0	0	0	1/6	0
2	0	0	1/6	0	1/6
MARG	1/6	1/6	2/6	1/6	1/6

```
X0 = [1/6 1/6 2/6 1/6 1/6];
```

```
bar([-2 -1 0 1 2], X0)  
title('PMF X(0)')  
xlabel('x')  
ylabel('f_x(X)')
```

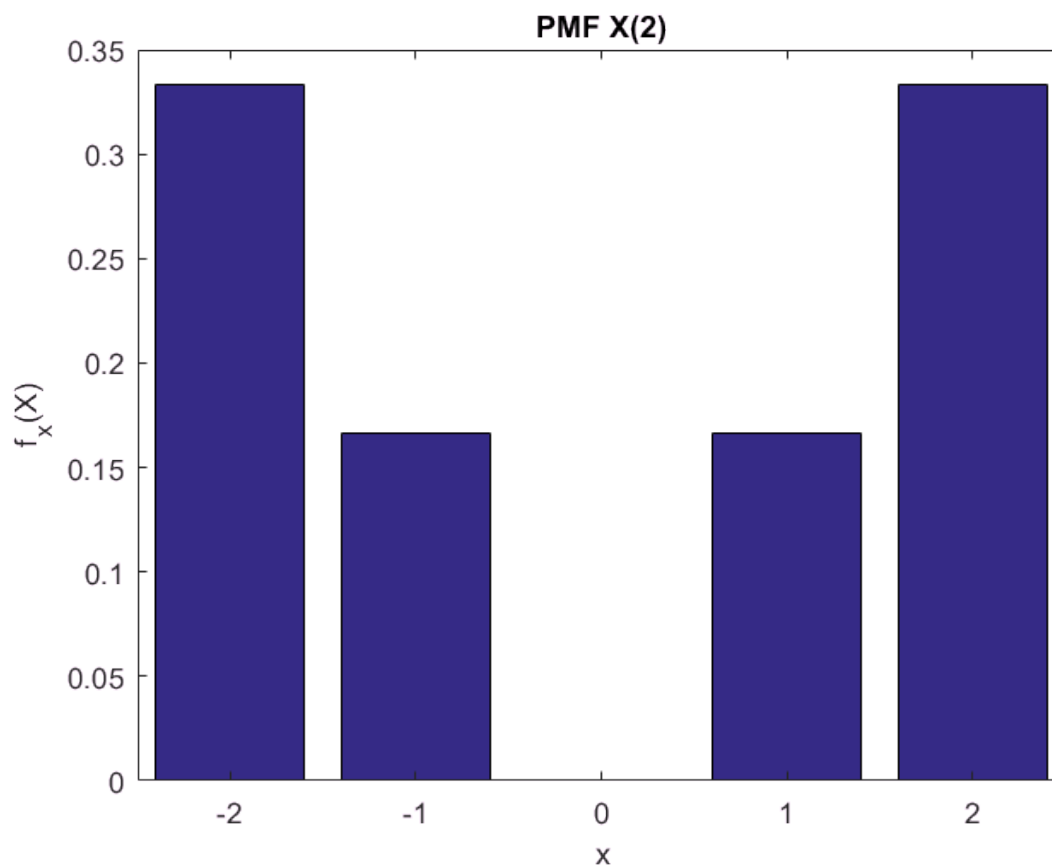


Marginal pmf of X(2)

$X(0) \backslash X(2)$	-2	-1	0	1	2	MARGI
-2	1/6	0	1/6	0	0	2/6
-1	0	1/6	0	0	0	1/6
0	0	0	0	0	0	0
1	0	0	0	1/6	0	1/6
2	0	0	1/6	0	1/6	2/6

```
X2 = [2/6 1/6 0 1/6 2/6];
```

```
bar([-2 -1 0 1 2], X2)  
title('PMF X(2)')  
xlabel('x')  
ylabel('f_x(X)')
```



c.

```
x = [-2 -1 0 1 2];  
X0 = [1/6 1/6 2/6 1/6 1/6];  
X2 = [2/6 1/6 0 1/6 2/6];
```

```
EX0 = sum(X0.*x)
```

```
EX0 = -5.5511e-17
```

```
EX2 = sum(X2.*x)
```

```
EX2 = 0
```

```
EX02 = sum((x.*x).*X0)
```

```
EX02 = 1.6667
```