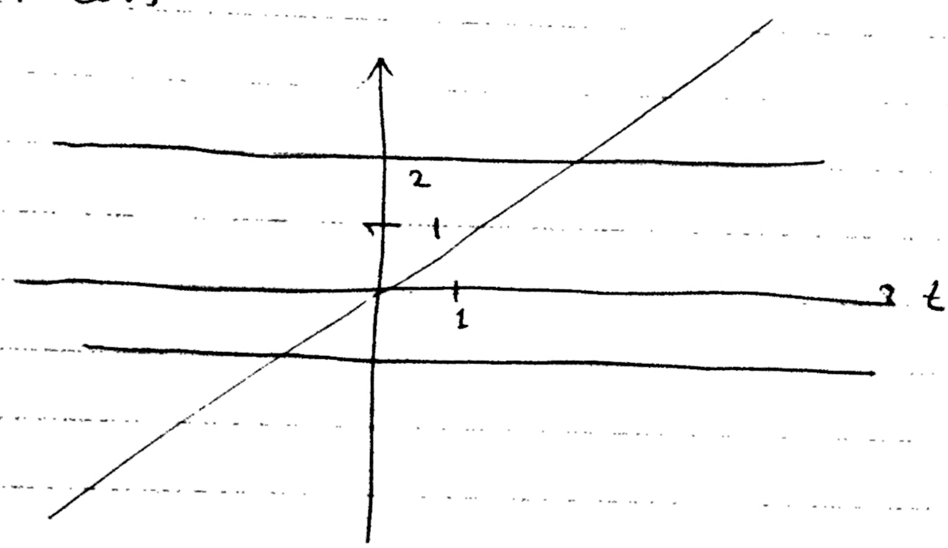
3.1 We define a random process $x(t)$

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

We show 3 realisations of the process

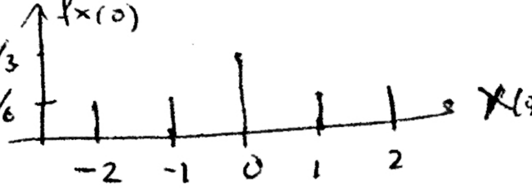


(a) The joint pmf $f_{x(0)x(2)}$ is

$x(2) \backslash x(0)$	-2	-1	0	1	2	total
-2	1/6	0	1/6	0	0	1/3
-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	1/3
total	1/6	1/6	1/3	1/6	1/6	1

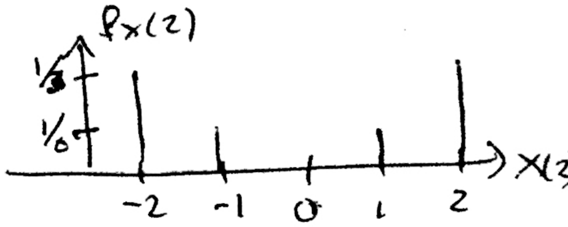
(b) The marginal pmf $f_{X(0)}$

	-2	-1	0	1	2
X(0)	1/6	1/6	1/3	1/6	1/6



The marginal pmf for f_{X_2}

	-2	-1	0	1	2
X(2)	1/3	1/6	0	1/6	1/3



(c)
$$E[X(0)] = \sum_i x_i(0)\cdot f_{X(0)}$$
$$= -2\cdot\tfrac{1}{6} - 1\cdot\tfrac{1}{6} + \tfrac{1}{3}\cdot 0 + 1\cdot\tfrac{1}{6} + 2\cdot\tfrac{1}{6}$$
$$= \underline{\underline{0}}$$

$$E[X(2)] = \sum_i x_i(2)\, f_{X(2)}$$
$$= -2\cdot\tfrac{1}{3} - 1\cdot\tfrac{1}{6} + \tfrac{1}{6}\cdot 1 + \tfrac{1}{3}\cdot 2$$
$$= \underline{\underline{0}}$$

$$E[X(0)\cdot X(2)] = \sum_i \sum_n x_i(0)\, x_n(2)\, f_{X(0)X(2)}$$
$$= (-2)\cdot(-2)\cdot\tfrac{1}{6} + (-1)\cdot(-1)\cdot\tfrac{1}{6} + 1\cdot 1\cdot\tfrac{1}{6} + \tfrac{1}{6}\cdot 2\cdot 2 = \underline{\underline{\tfrac{5}{3}}}$$