EE23010 Assignment

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Question 12.13.3.103
If A, B and C are three independent events such that $\Pr(A) = \Pr(B) = \Pr(C) = p$, then
P(At least two of A, B, C occur) $= 3p^2 - 2p^3$
Solution:

RV	Value	Description
X	0	none of the events occur
	1	only one of the events occur
	2	any two of the events occur
	3	all the three events occur

TABLE 0
RANDOM VARIABLE DECLARATION

$$\Pr(X=0) = \Pr(A'B'C') \tag{1}$$
$$= \Pr(A')\Pr(B')\Pr(C') \tag{2}$$
$$= (1-p)^3 \tag{3}$$
$$\Pr(X=1) = \Pr(AB'C') + \Pr(BC'A') + \Pr(CA'B') \tag{4}$$
$$= \Pr(A)\Pr(B')\Pr(C') + \Pr(B)\Pr(C')\Pr(A') + \Pr(C)\Pr(A')\Pr(B') \tag{5}$$
$$= 3p(1-p)^2 \tag{6}$$
$$\Pr(X=2) = \Pr(ABC') + \Pr(BCA') + \Pr(CAB') \tag{7}$$
$$= \Pr(A)\Pr(B)\Pr(C') + \Pr(B)\Pr(C)\Pr(A') + \Pr(C)\Pr(A)\Pr(B') \tag{8}$$
$$= 3p^2(1-p) \tag{9}$$
$$\Pr(X=3) = \Pr(ABC) \tag{10}$$
$$= \Pr(A)\Pr(B)\Pr(C) \tag{11}$$
$$= p^3 \tag{12}$$

$$\Pr(X \geq 2) = \Pr(X=2) + \Pr(X=3) \tag{13}$$
$$= 3p^2(1-p) + p^3 \tag{14}$$
$$= 3p^2 - 2p^3 \tag{15}$$