Q Box 1 contains three cards bearing numbers, 1,2,3; Box 2 contains five cards bearing numbers 1,2,3,4,5; and Box 3 contains seven cards bearing numbers 1,2,3, 4,5,6,7. A card is drawn from each of the boxes. Let x_i be the number on the card drawn from the ith box, $i=1,2,3$

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(a) The probability that $x_1+x_2+x_3$ is odd, is

(A) $\frac{29}{105}$ (B) $\frac{53}{106}$ (C) $\frac{57}{105}$ (D) $\frac{1}{2}$

- $x_1+x_2+x_3 \rightarrow$ Odd

odd + odd + odd $\Rightarrow \frac{2}{3}\cdot\frac{3}{5}\cdot\frac{4}{7}=\frac{24}{105}$

odd + even + even $\Rightarrow \frac{2}{3}\cdot\frac{2}{5}\cdot\frac{3}{7}=\frac{12}{105}$

even + odd + even $\Rightarrow \frac{1}{3}\cdot\frac{3}{5}\cdot\frac{3}{7}=\frac{9}{105}$

even + even + odd $\Rightarrow \frac{1}{3}\cdot\frac{2}{5}\cdot\frac{4}{7}=\frac{8}{105}$

total $= \frac{24+12+9+8}{105}=\frac{53}{105}$

(b) The probability that x_1, x_2, x_3 are in arithmetic progression is

(A) $\frac{9}{105}$ (B) $\frac{10}{105}$ (C) $\frac{11}{105}$ (D) $\frac{7}{105}$

- $2x_2 = x_1 + x_3$

$x_1+x_3 \rightarrow$ even for every x_2

even + even $\Rightarrow \left(\frac{1}{3}\cdot\frac{3}{7}\right)\frac{1}{5}=\frac{3}{105}$

Odd + Odd $\Rightarrow \left(\frac{2}{3}\cdot\frac{4}{7}\right)\frac{1}{5} = \frac{8}{105}$

total $= \frac{8+3}{105} = \frac{11}{105}$

Q The minimum no. of times a fair coin needs to be tossed, so that the probability of getting at least two heads is at least 0.96 is

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- Let no. of tosses be n

Probability of getting atleast two heads

$= 1 - \left(\frac{1}{2}\right)^n - {}^nC_1\left(\frac{1}{2}\right)^{n-1}\cdot\frac{1}{2}$

$\Rightarrow 1 - \frac{n+1}{2^n} \geq \frac{24}{25}$

$\Rightarrow \frac{n+1}{2^n} \leq \frac{1}{25}$ $\quad n=8$

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