1) Probability to end at M after N steps
2) Probability to stay positive at all times
3) Find the probability to spend all the time near 0 (in [0, k]), for a given k

1) $\frac{C\binom{2}{N}}{2^N}$

Homework

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1 a) $P(\min(x_1, x_2)) < \frac{1}{3} \Rightarrow$

$\Rightarrow P(x_1 < \frac{1}{3} \text{ or } x_2 < \frac{1}{3}) =$

$= 1 - (P(x_1 < \frac{1}{3}) \text{ or } P(x_2 < \frac{1}{3}))' =$

$= 1 - (P(x > \frac{1}{3}) \text{ and } P(x > \frac{1}{3})) =$

$\boxed{= 1 - \left(\frac{608}{1000} \cdot \frac{608}{1001}\right)} = \boxed{0.63107}$

b) $P(\text{exactly } 2) =$

$= 1 - \left(C\binom{4}{0}\left(\frac{1}{3}\right)^4 + C\binom{4}{1}\left(\frac{1}{3}\right)^3\left(\frac{2}{3}\right) + C\binom{4}{3}\left(\frac{1}{3}\right)^1\left(\frac{2}{3}\right)^3 + C\binom{4}{4}\left(\frac{2}{3}\right)^4\right)$

$= 1 - \frac{57}{81} = \frac{24}{81} = \boxed{\frac{8}{27}}$

3

A - disease

B - test positive

$P(A) = 0.1\% = \frac{1}{1000}$

$P(B|A) = \frac{9}{10} = \frac{P(A \cdot B)}{P(A)}$

$P(A \cdot B) = \frac{9}{10000}$

$P(B|\bar{A}) = \frac{1}{100} = \frac{P(\bar{A} \cdot B)}{P(\bar{A})} = \frac{1}{1000}$

$P(A|B) = \frac{P(A \cdot B)}{P(B)}$

N3 $P(A)=\frac{1}{1000}$

$P(B|A)=90\%=\frac{9}{10}$

$P(B|\bar{A})=1\%=\frac{1}{100}$

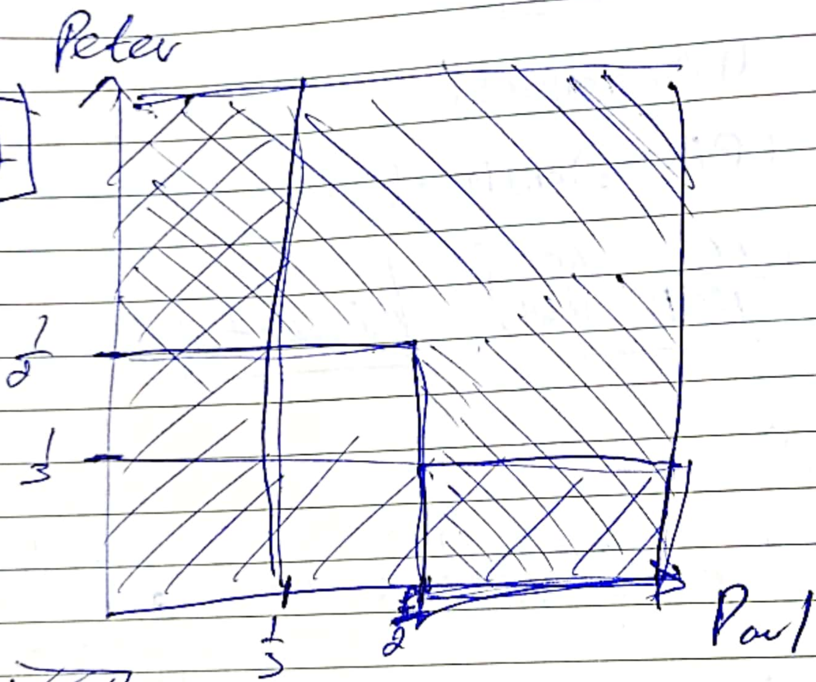
find $P(A|B)$

$\boxed{\text{Solution}}$

$P(\text{disease})=\frac{1}{1000}$

$P(\text{positive}|\text{disease})=\frac{9}{10}$

$\boxed{\text{N1}}$



A =

B =

$P(A\cdot B)=2\left(\frac{1}{3}\cdot\frac{1}{2}\right)=\frac{1}{3}$

$P(A)=1-P(\bar{A})=1-\frac{4}{9}=\frac{5}{9}$

$P(B)=1-P(\bar{B})=1-\frac{1}{4}=\frac{3}{4}$

If $P(A\cdot B)=P(A)\cdot P(B) \Rightarrow$ A & B indep

$\frac{5}{9}\neq\frac{5}{9}\cdot\frac{3}{4}\neq\frac{5}{12}$ $\Rightarrow$ A & B dependent