Homework 10

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Problem 1. n green, n red in box

a) prob of picking K green balls?

$P(n) = \binom{n}{k} p^k (1-p)^{n-k} \rightarrow p(n) = \binom{n}{k} 0.5^k (1-0.5)^{n-k} \rightarrow \binom{n}{k} 0.5^k (0.5)^{n-k}$

b) Probability mass function? ~~P(X)~~ $= P(X=K) = \frac{\binom{n}{k}\binom{n}{n-k}}{\binom{2n}{n}}$

c) $1 for every green, $10 more if you pick all n green balls. What is your expected gain?

$\$1 \cdot n + \$10$ or $\$1 \cdot K$ (number of green balls picked)

Problem 2. $p = 0.01$ of having flu, if sick 90%, if healthy 80%

1. if positive, prob of being sick? $P(\text{positive} \mid \text{sick})$

$\rightarrow \frac{P(\text{sick} \mid \text{positive}) \times P(\text{positive})}{P(\text{sick})} \rightarrow \frac{(0.9)(0.207)}{(0.01)} = 20.9\%$

$\rightarrow \frac{(1 - 9/207)(0.207)}{(1-0.001)} = 20\%$

	sick	not sick	
test (+)	9	198	207
test (-)	1	792	793
	10	990	100

2. if a person is tested twice (positive), prop of being sick?

$E(x) = 1 - (1-p)^{[x]} \rightarrow 1 - (1-0.2)^2 = 1 - (0.8)^2 = 1 - 0.64 = 0.36 = 36\%$

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Problem 4

ensemble of $N = 2n + 1$, independent binary classifiers, $p > 1/2$

a) what is the accuracy of using $N = 3$?

if $N = 3 \rightarrow 3 = 2n + 1 \rightarrow 2n = 2 \rightarrow n = 2/2 \rightarrow n = 1$

↑ accuracy = 0.5

Problem 5

a) Probability distribution table for x?

	1	2	3	4	5	6
x	$1	-$2	$3	-$4	$5	-$6
Prob	1/6	1/6	1/6	1/6	1/6	1/6

b) expected value of x?

$$E[x] = (1 \cdot 1/6) + (-2 \cdot 1/6) + (3 \cdot 1/6) + (-4 \cdot 1/6) + (5 \cdot 1/6) + (-6 \cdot 1/6) = -0.5$$