| Benha University <br> Engineering Mathematics and <br> Physics Department <br> $1^{\text {st }}$ semester 2012-2013 | Faculty of Engineering (Shoubra) <br> Electrical Engineering (communication) <br> Mathematics 3A - Code: EMP 281 <br> Mid term exam (13 marks) |
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| Student Name in Arabic: | Section: |
| AnSWer the following questions |  |

1- Suppose there are 5 black, 10 white, and 15 red marbles in an urn. You reach in and randomly select six marbles without replacement. What is the probability that you pick exactly two red marbles? Find $\mathrm{E}(\mathrm{X})$ and $\operatorname{var}(\mathrm{X})$
$\mathrm{n}=6, \mathrm{~N}=30, \mathrm{k}=15$, therefore $\mathrm{P}(\mathrm{X}=2)=\left[{ }^{15} \mathrm{C}_{2}\right]\left[{ }^{15} \mathrm{C}_{4}\right] /\left[{ }^{30} \mathrm{C}_{6}\right]$
$\mathrm{E}(\mathrm{X})=\mathrm{n}(\mathrm{k} / \mathrm{N})=6(15 / 30)=3$, and $\mathrm{V}(\mathrm{X})=\left(\frac{\mathrm{N}-\mathrm{n}}{\mathrm{N}-1}\right) \mathrm{n}\left(\frac{\mathrm{k}}{\mathrm{N}}\right)\left(1-\frac{\mathrm{k}}{\mathrm{N}}\right)=\frac{36}{29}$

2- Two fair dice are rolled, what is the probability that the first turns up six, given that the sum is k , for each k from two through 12 ?
$\mathrm{A}=\{$ first turns up six $\}=\{(6,1),(6,2),(6,3),(6,4),(6,5),(6,6)\}$
$\mathrm{B}=\{$ the sum is k , for each k from two through 12$\}$, therefore $\mathrm{P}(\mathrm{A} / \mathrm{B})=0$ for $\mathrm{k}=2,3, \ldots, 6$.

At $k=7, B=\{(1,6),(2,5),(3,4),(4,3),(5,2),(6,1)\}$, thus $P(A / B)=1 / 6$
$\mathrm{k}=8, \mathrm{~B}=\{(2,6),(3,5),(4,4),(5,3),(6,2)\}$, thus $\mathrm{P}(\mathrm{A} / \mathrm{B})=1 / 5$
$\mathrm{k}=9, \mathrm{~B}=\{(3,6),(4,5),(5,4),(6,3)\}$, thus $\mathrm{P}(\mathrm{A} / \mathrm{B})=1 / 4$
$\mathrm{k}=10, \mathrm{~B}=\{(4,6),(5,5),(6,4)\}$, thus $\mathrm{P}(\mathrm{A} / \mathrm{B})=1 / 3$
$\mathrm{k}=11, \mathrm{~B}=\{(5,6),(6,5)\}$, thus $\mathrm{P}(\mathrm{A} / \mathrm{B})=1 / 2$
$\mathrm{k}=12, \mathrm{~B}=\{(6,6)\}$, thus $\mathrm{P}(\mathrm{A} / \mathrm{B})=1$

3- The density function of $X$ is given by $f(x)=\left\{\begin{array}{lc}a-b x^{2} & 0<x<1 \\ 0 & \text { otherwise }\end{array}\right.$, If $E(X)=3 / 5$, find $a$ and $b$.

Since $\int_{0}^{1} x\left(a-b x^{2}\right) d x=0.6$, therefore $\left[a \frac{x^{2}}{2}-b \frac{x^{4}}{4}\right]_{0}^{1}=0.6$, thus $2 a-b=2.4$, but $\int_{0}^{1}\left(a-b x^{2}\right) d x=1$, therefore $\left[a x-b \frac{x^{3}}{3}\right]_{0}^{1}=1$, thus $3 a-b=3$, so $a=0.6$ and $b=-1.2$

## Good Luck

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