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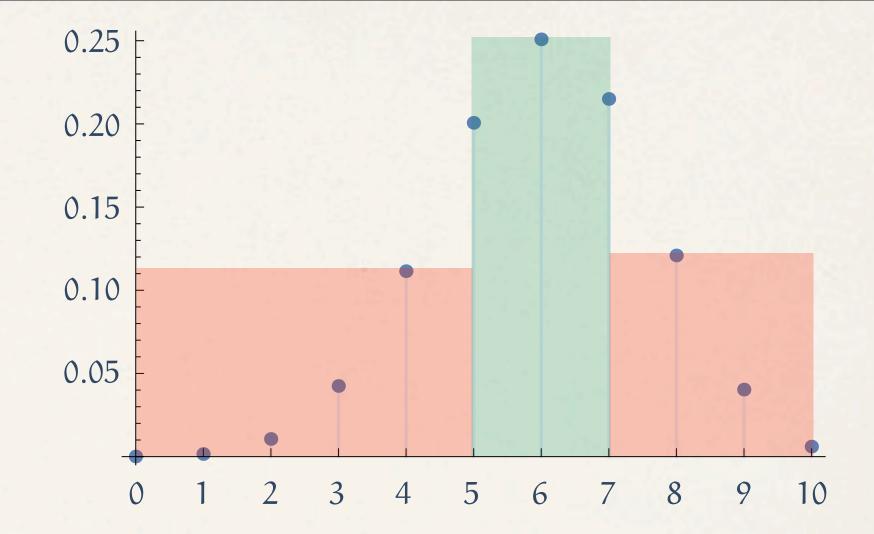
$$\mathbf{P}\left\{\left|\frac{S_n}{n}-p\right|>\epsilon\right\}$$

$$\sum_{k=0}^{n} (k - np)^2 \cdot b_n(k; p) = npq$$

$$\mathbf{P}\left\{\left|\frac{S_n}{n} - \mathbf{p}\right| > \epsilon\right\} = \mathbf{P}\left\{|S_n - \mathbf{n}\mathbf{p}| > \mathbf{n}\epsilon\right\}$$

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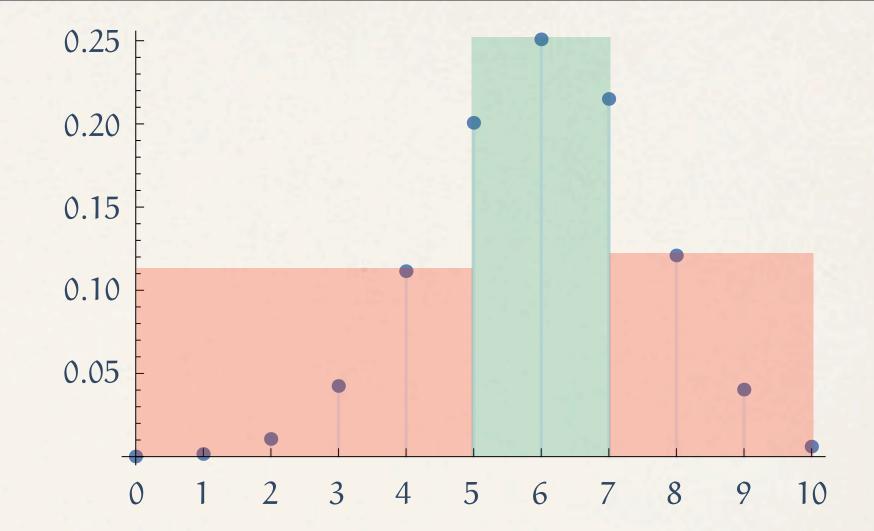
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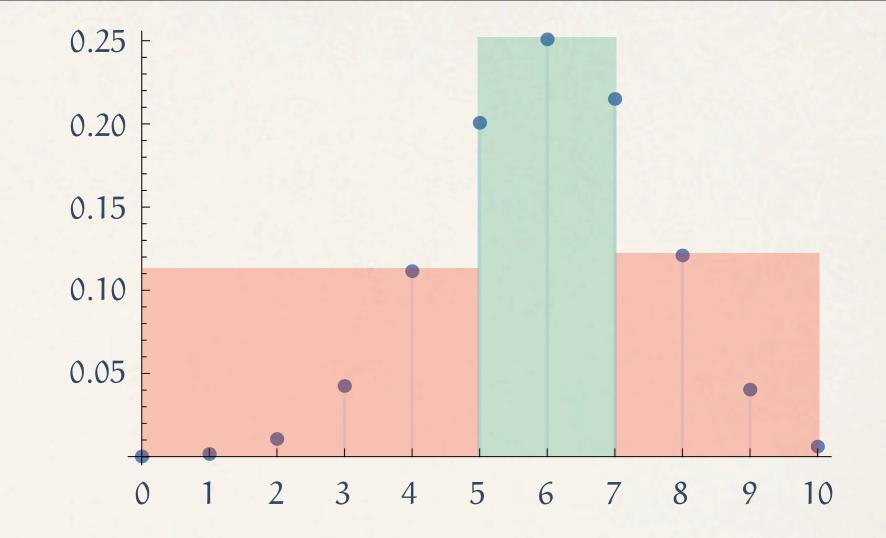
$$= \sum_{k:|k-n\mathbf{p}| > n\mathbf{\epsilon}} b_{n}(k;\mathbf{p})$$



$$\sum_{k=0}^{n} (k - np)^2 \cdot b_n(k;p) = npq$$

$$\mathbf{P}\left\{ \left| \frac{S_{n}}{n} - \mathbf{p} \right| > \epsilon \right\} = \mathbf{P}\left\{ |S_{n} - \mathbf{n}\mathbf{p}| > \mathbf{n}\epsilon \right\}$$

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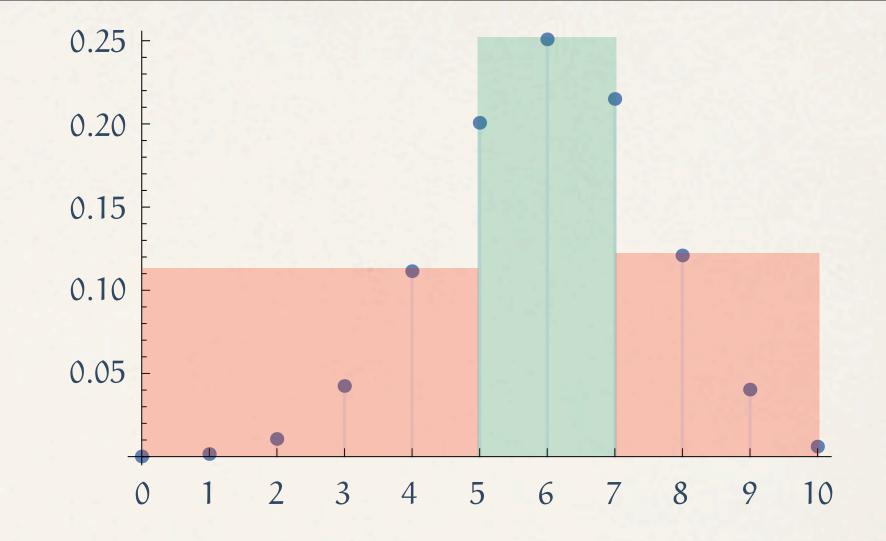
This means: sum over all integers k such that  $|k - np| > n\epsilon$ . (That is to say, either  $0 \le k < np - n\epsilon$  or  $np + n\epsilon < k \le n$ .)

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$$= \sum_{k:|k-\mathbf{n}\mathbf{p}| > \mathbf{n}\mathbf{\epsilon}} b_{n}(k;\mathbf{p})$$

$$= \sum_{k:|k-\mathbf{n}\mathbf{p}| > \mathbf{n}\mathbf{\epsilon}} 1 \cdot b_{n}(k;\mathbf{p})$$



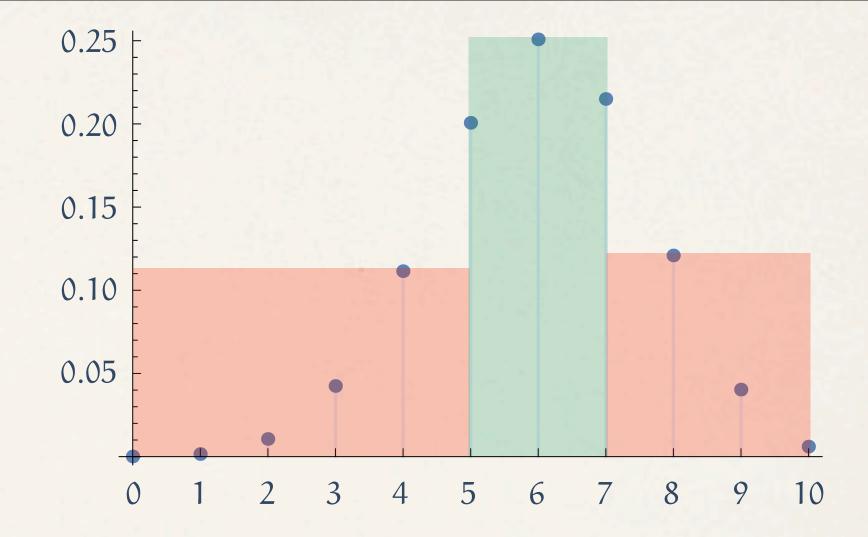
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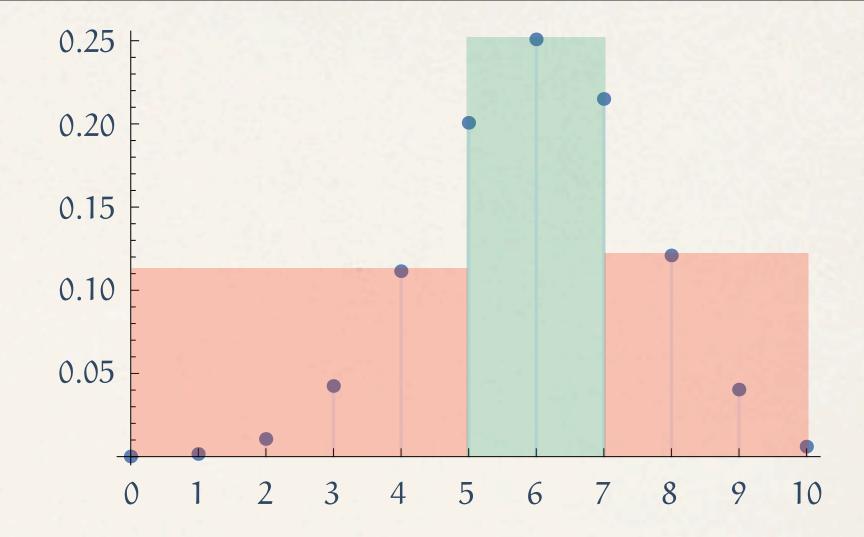
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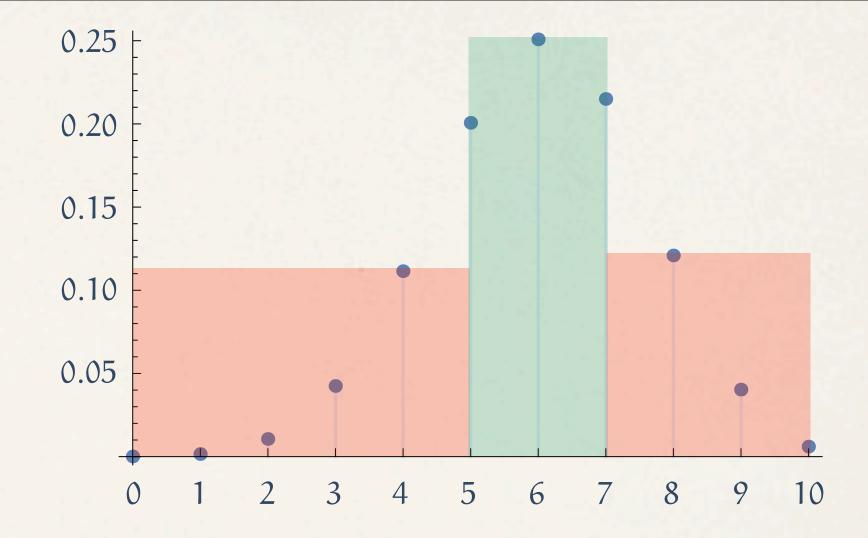


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$$\sum_{k=0}^{n} (k - np)^2 \cdot b_n(k; p) = npq$$

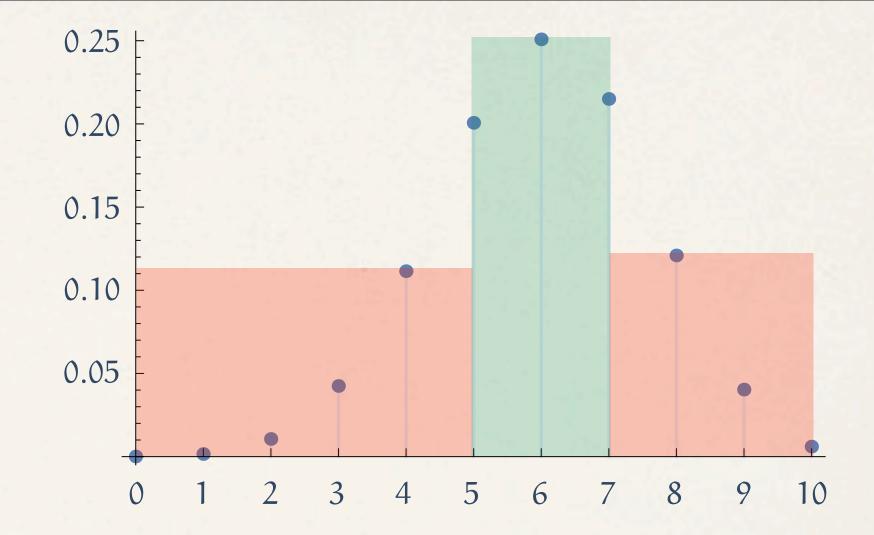
$$\mathbf{P}\left\{\left|\frac{S_{n}}{n} - p\right| > \epsilon\right\} = \mathbf{P}\left\{\left|S_{n} - np\right| > n\epsilon\right\} \\
= \sum_{k:|k-np|>n\epsilon} b_{n}(k;p) \\
= \sum_{k:|k-np|>n\epsilon} 1 \cdot b_{n}(k;p) \\
\leq \sum_{k:|k-np|>n\epsilon} \frac{(k-np)^{2}}{n^{2}\epsilon^{2}} \cdot b_{n}(k;p)$$



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$$\begin{split} \mathbf{P} \bigg\{ \left| \frac{S_n}{n} - \mathbf{p} \right| > \mathbf{\epsilon} \bigg\} &= \mathbf{P} \big\{ |S_n - n\mathbf{p}| > n\mathbf{\epsilon} \big\} \\ &= \sum_{k:|k-n\mathbf{p}| > n\mathbf{\epsilon}} b_n(k;\mathbf{p}) \\ &= \sum_{k:|k-n\mathbf{p}| > n\mathbf{\epsilon}} 1 \cdot b_n(k;\mathbf{p}) \\ &\leq \sum_{k:|k-n\mathbf{p}| > n\mathbf{\epsilon}} \frac{(k-n\mathbf{p})^2}{n^2 \mathbf{\epsilon}^2} \cdot b_n(k;\mathbf{p}) \\ &\leq \sum_{m} \frac{(k-m\mathbf{p})^2}{n^2 \mathbf{\epsilon}^2} \cdot b_m(k;\mathbf{p}) \end{split}$$



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$$\sum_{k=0}^{n} (k - np)^2 \cdot b_n(k;p) = npq$$

$$P\left\{\left|\frac{S_{n}}{n} - p\right| > \epsilon\right\} = P\left\{\left|S_{n} - np\right| > n\epsilon\right\}$$

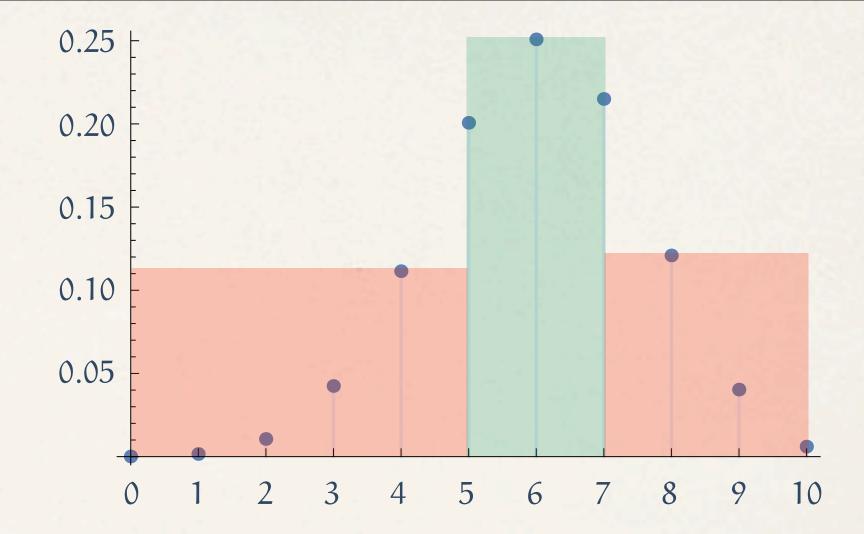
$$= \sum_{k:|k-np|>n\epsilon} b_{n}(k;p)$$

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$$\leq \sum_{k:|k-np|>n\epsilon} \frac{(k-np)^{2}}{n^{2}\epsilon^{2}} \cdot b_{n}(k;p)$$

$$\leq \sum_{k=0}^{n} \frac{(k-np)^{2}}{n^{2}\epsilon^{2}} \cdot b_{n}(k;p)$$

$$= \frac{1}{n^{2}\epsilon^{2}} \sum_{k=0}^{n} (k-np)^{2} \cdot b_{n}(k;p)$$



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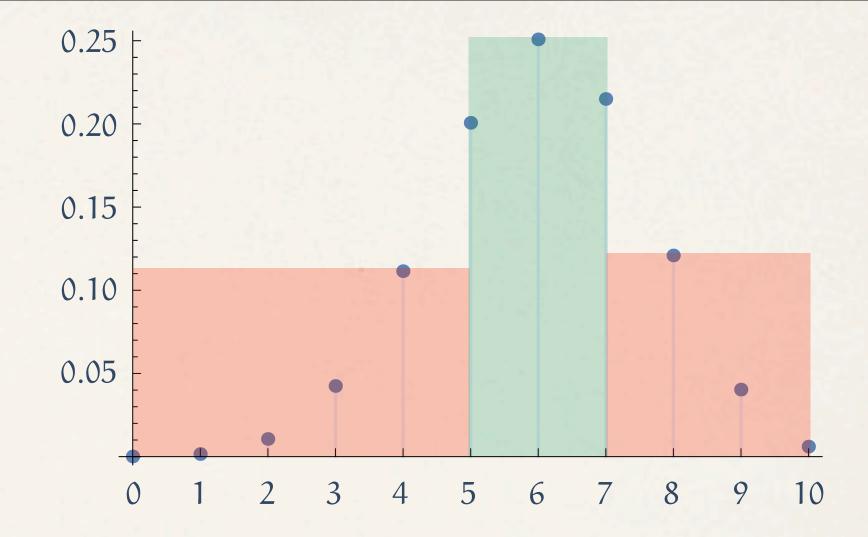
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We wish to estimate. 
$$P\left\{\left|\frac{S_n}{n} - p\right| > \epsilon\right\} = P\left\{|S_n - np| > n\epsilon\right\}$$

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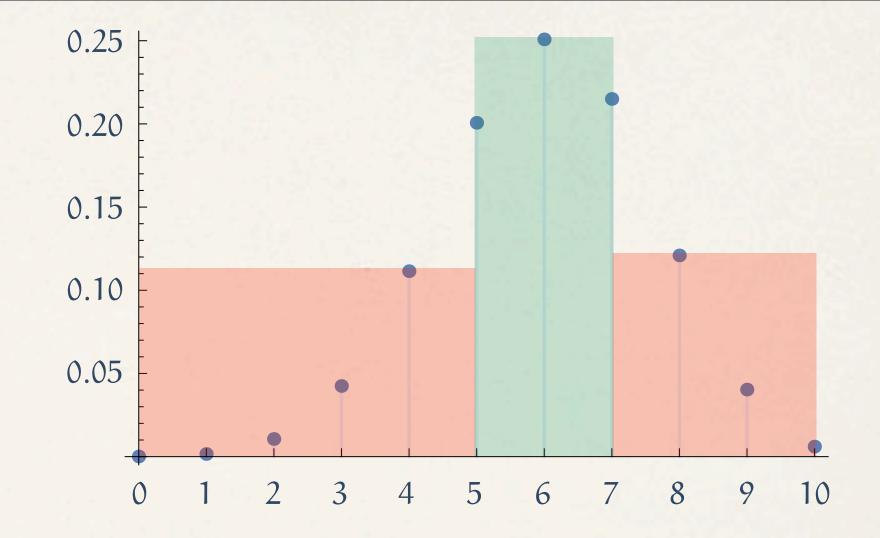
$$= \sum_{k:|k-np|>n\epsilon} 1 \cdot b_n(k;p)$$

$$\leq \sum_{k:|k-np|>n\epsilon} \frac{(k-np)^2}{n^2\epsilon^2} \cdot b_n(k;p)$$

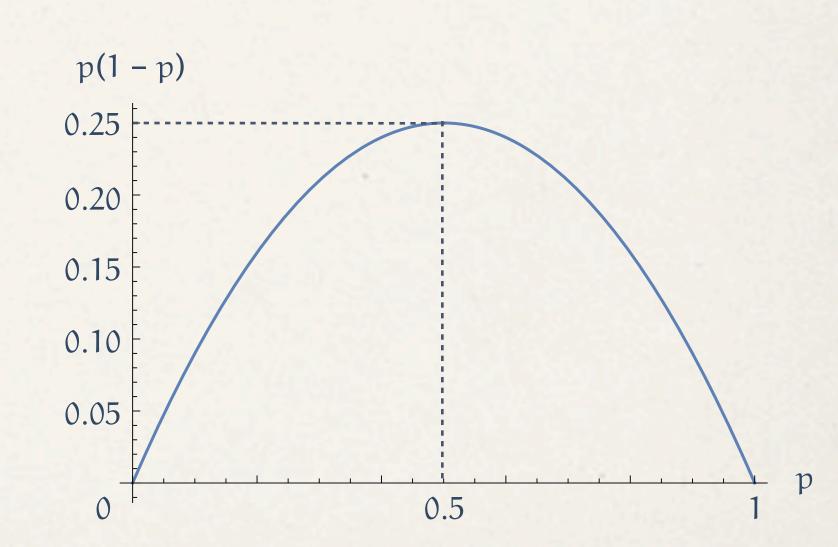
$$\leq \sum_{k=0}^n \frac{(k-np)^2}{n^2\epsilon^2} \cdot b_n(k;p)$$

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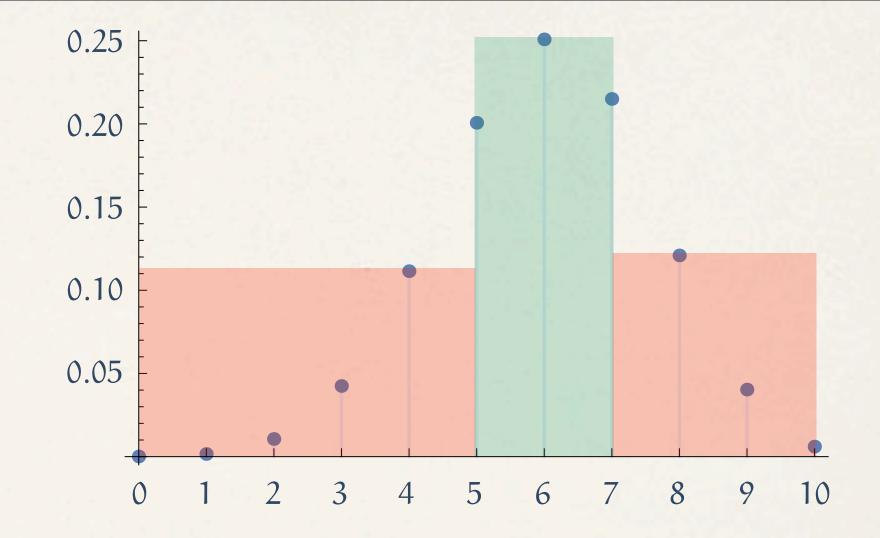
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$$\leq \sum_{k=0}^n \frac{(k-np)^2}{n^2 \epsilon^2} \cdot b_n(k;p)$$

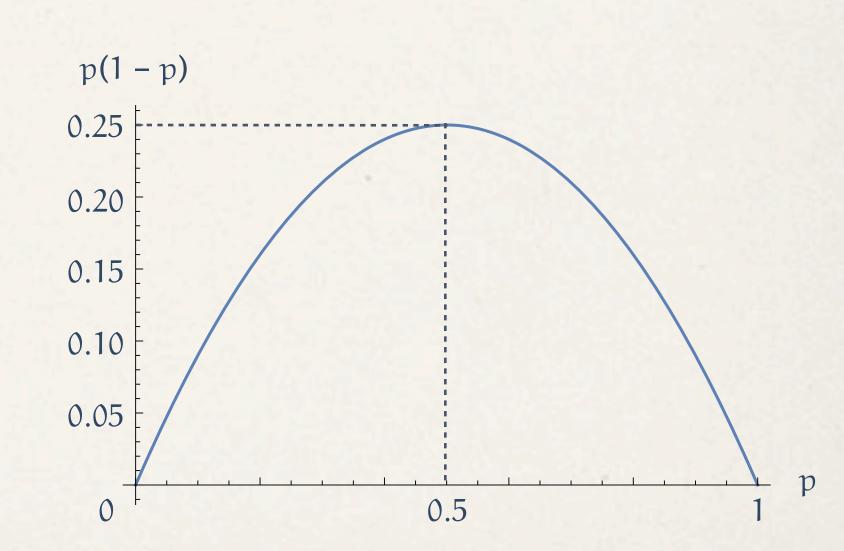
$$= \frac{1}{n^2 \epsilon^2} \sum_{k=0}^n (k-np)^2 \cdot b_n(k;p)$$

$$= \frac{1}{n^2 \epsilon^2} \cdot npq = \frac{p(1-p)}{n\epsilon^2} \leq \frac{1}{4n\epsilon^2}$$



This means: sum over all integers k such that  $|k - np| > n\epsilon$ . (That is to say, either  $0 \le k < np - n\epsilon$  or  $np + n\epsilon < k \le n$ .) Which means:  $\frac{|k-np|}{nc} > 1$ .

Or, equivalently:  $\frac{(k-np)^2}{n^2c^2} > 1$ .



$$\sum_{k=0}^{n} (k - np)^2 \cdot b_n(k;p) = npq$$

We wish to estimate: 
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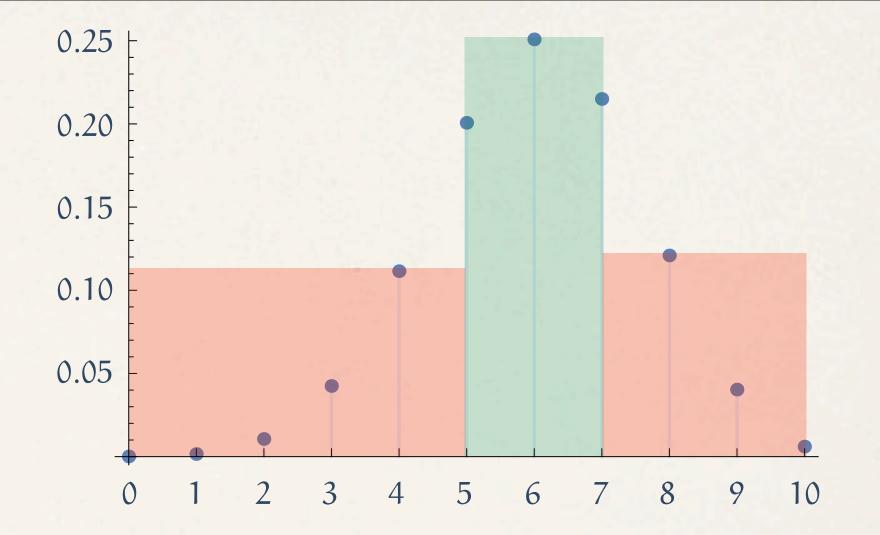
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p has vanished!

