Calculating Variance of Discrete Frequency Distribution

Data Science and A.I. Lecture Series

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Find the value of a while Var(X)=160.

x_i	a	$2a$	$3a$	$4a$	$5a$	$6a$
f_i	2	1	1	1	1	1

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$f_i x_i^2$						

Find the value of a while Var(X)=160.

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$f_i x_i$	$2a$	$2a$	$3a$	$4a$	$5a$	$6a$
$f_i x_i^2$	$2a^2$	$4a^2$				

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$f_i x_i$	$2a$	$2a$	$3a$	$4a$	$5a$	$6a$
$f_i x_i^2$	$2a^2$	$4a^2$	$9a^2$			

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f_i	2	1	1	1	1	1
$f_i x_i$	$2a$	$2a$	$3a$	$4a$	$5a$	$6a$
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$f_i x_i$	$2a$	$2a$	$3a$	$4a$	$5a$	$6a$
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Let us calculate the following

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$N = \sum f_i = 7, \sum f_i x_i = 22a, \quad \sum f_i x_i^2 = 92a^2$

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Variance formula

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$f_i x_i$	$2a$	$2a$	$3a$	$4a$	$5a$	$6a$
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$Variance = \frac{1}{N} \sum f_i x_i^2 - \left(\frac{1}{N} \sum f_i x_i\right)^2$

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$f_i x_i$	$2a$	$2a$	$3a$	$4a$	$5a$	$6a$
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Substituting the known values:

$160 = \frac{1}{7} \times 92a^2 - \left(\frac{22a}{7}\right)^2$

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$f_i x_i$	$2a$	$2a$	$3a$	$4a$	$5a$	$6a$
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Expanding this:

Find the value of a while Var(X)=160.

x_i	a	$2a$	$3a$	$4a$	$5a$	$6a$
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$f_i x_i$	$2a$	$2a$	$3a$	$4a$	$5a$	$6a$
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$N = \sum f_i = 7, \sum f_i x_i = 22a, \quad \sum f_i x_i^2 = 92a^2$

Variance formula

$Variance = \frac{1}{N} \sum f_i x_i^2 - \left(\frac{1}{N} \sum f_i x_i\right)^2$

Substituting the known values:

$160 = \frac{1}{7} \times 92a^2 - \left(\frac{22a}{7}\right)^2$

Expanding this:

$160 = \frac{92a^2}{7} - \frac{484a^2}{49}$

Find the value of a while Var(X)=160.

x_i	a	$2a$	$3a$	$4a$	$5a$	$6a$
f_i	2	1	1	1	1	1
$f_i x_i$	$2a$	$2a$	$3a$	$4a$	$5a$	$6a$
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$160 = \frac{92a^2}{7} - \frac{484a^2}{49}$

Combining the terms

Find the value of a while Var(X)=160.

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Expanding this:

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Combining the terms

$160 = \frac{644a^2 - 484a^2}{49}$

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Expanding this:

$160 = \frac{92a^2}{7} - \frac{484a^2}{49}$

Combining the terms

$160 = \frac{644a^2 - 484a^2}{49}$

Thus

$160 = \frac{160a^2}{49}, a = \sqrt{49} = 7$

Find the value of a while Var(X)=160.

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Result

a=7