

Probabilités : calculs avec xint – illustrations avec PSTricks

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1 Probabilité

Donner la liste suivante des couples $x_i | P(X = x_i)$: ces valeurs ne sont séparées que par des espaces.

```
\GenerateProbLists{LP}{2 1/36 3 2/36 4 3/36 5 4/36 6 5/36 7 1/6 8 5/36 9 4/36 10 3/36 11 2/36 12 1/36}
```

1.1 Table des éléments de la liste

x_i	2	3	4	5	6	7	8	9	10	11	12
$P(X = x_i)$	$\frac{1}{36}$	$\frac{1}{18}$	$\frac{1}{12}$	$\frac{1}{9}$	$\frac{5}{36}$	$\frac{1}{6}$	$\frac{5}{36}$	$\frac{1}{9}$	$\frac{1}{12}$	$\frac{1}{18}$	$\frac{1}{36}$

```
\begin{tabular}{|c|*{\xintiieval{NrOfBr_LP}}{c|}}
\hline
\vrule height 3ex depth 1.5ex width 0pt\relax %%%%%%%%%
 $x_{\{i\}}$                       \xintFor* #1 in {\LPDB} \do {\&\bfseries \onlyfirst{#1}}{\}
\hline
\vrule height 4.5ex depth 3ex width 0pt\relax
 $\backslash Prob(X=x_{\{i\}})$     \xintFor* #1 in {\LPDB} \do %%%%%%%%%
{&\$&\displaystyle\xintSignedFrac{\macroCalc{\onlysecond{#1}}}{\$}}\}
\hline
\end{tabular}
```

1.2 Espérance

$$E(X) = x_1 \cdot P(X = x_1) + x_2 \cdot P(X = x_2) + \dots = \mu$$

On calcule automatiquement la valeur de l'espérance, pas à pas :

$$\begin{aligned} E(X) &= 2 \cdot \frac{1}{36} + 3 \cdot \frac{1}{18} + 4 \cdot \frac{1}{12} + 5 \cdot \frac{1}{9} + 6 \cdot \frac{5}{36} + 7 \cdot \frac{1}{6} + 8 \cdot \frac{5}{36} + 9 \cdot \frac{1}{9} + 10 \cdot \frac{1}{12} + 11 \cdot \frac{1}{18} + 12 \cdot \frac{1}{36} \\ &= \frac{1}{18} + \frac{1}{6} + \frac{1}{3} + \frac{5}{9} + \frac{5}{6} + \frac{7}{6} + \frac{10}{9} + 1 + \frac{5}{6} + \frac{11}{18} + \frac{1}{3} = 7 \end{aligned}$$

```
\begin{align*}
\backslash Expect(X)    &= \xintListWithSep{+}{\xintApply{\macroFraccdotBracket}{\LPDB}}\}
&= \xintListWithSep{+}{\xintApply{\macroMulSgn}{\LPDB}}\}%
= \xintSignedFrac{\xinttheexpr mue_LP\relax}%
%\approx \np{\xintDecToString{\xintREZ{\xinttheiexpr[3] mue_LP\relax}}}
\end{align*}
```

1.3 Variance

$$\text{Var}(X) = (x_1 - \mu)^2 \cdot \text{P}(X = x_1) + (x_2 - \mu)^2 \cdot \text{P}(X = x_2) + \dots = \sigma^2$$

On calcule automatiquement la variance – pas à pas :

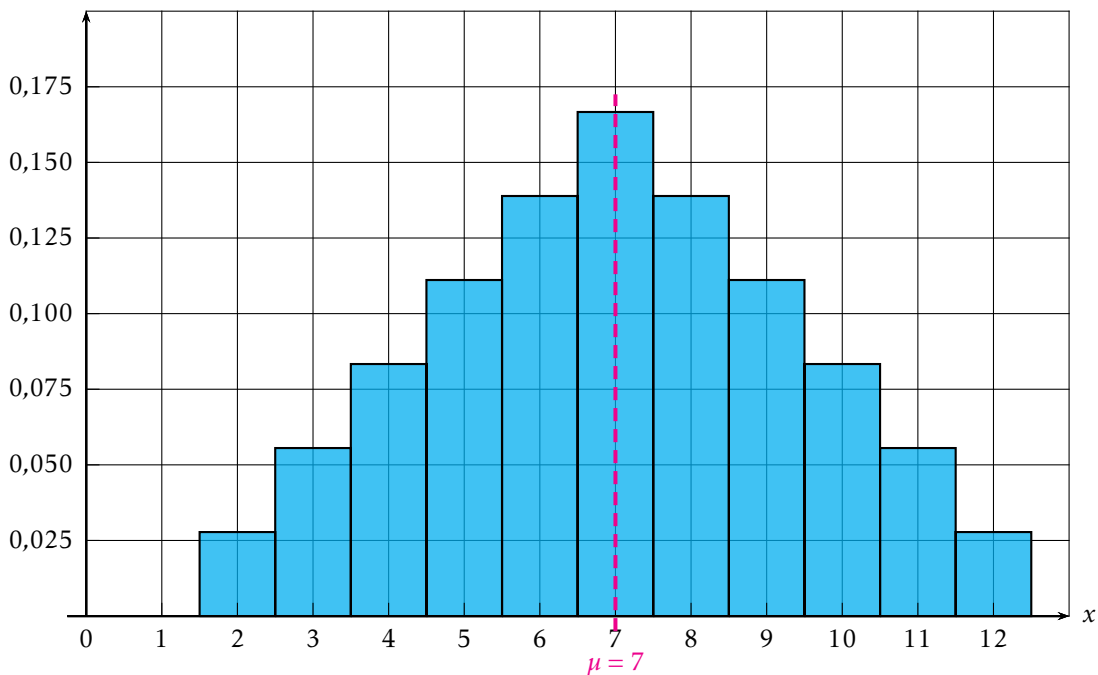
$$\begin{aligned}\text{Var}(X) &= (2-7)^2 \cdot \frac{1}{36} + (3-7)^2 \cdot \frac{1}{18} + (4-7)^2 \cdot \frac{1}{12} + (5-7)^2 \cdot \frac{1}{9} + (6-7)^2 \cdot \frac{5}{36} + (7-7)^2 \cdot \frac{1}{6} \\ &\quad + (8-7)^2 \cdot \frac{5}{36} + (9-7)^2 \cdot \frac{1}{9} + (10-7)^2 \cdot \frac{1}{12} + (11-7)^2 \cdot \frac{1}{18} + (12-7)^2 \cdot \frac{1}{36} \\ &= 25 \cdot \frac{1}{36} + 16 \cdot \frac{1}{18} + 9 \cdot \frac{1}{12} + 4 \cdot \frac{1}{9} + 1 \cdot \frac{5}{36} + 0 \cdot \frac{1}{6} \\ &\quad + 1 \cdot \frac{5}{36} + 4 \cdot \frac{1}{9} + 9 \cdot \frac{1}{12} + 16 \cdot \frac{1}{18} + 25 \cdot \frac{1}{36} \\ &= \frac{35}{6} \approx 5.833 \quad \Rightarrow \quad \sigma = \sqrt{\text{Var}(X)} \approx 2.415\end{aligned}$$

```

%% Prepare the line breaks for the "align*" environment:
%% The comma separated list (6,5) tells:
%% First row 6 x_i
%% Second row 5 x_i
\listSplitting{6,5}{ListPart}{\LPDB}
\listSplitting{6,5}{LBreakVar}{\LPVar}
%
\begin{align*}
\text{Var}(X) \; \&= \; \xintListWithSep{+}{\xintApply{\macroFraccdotBracketVar}{\ListParti}}\!\!
&\quad + \; \xintListWithSep{+}{\xintApply{\macroFraccdotBracketVar}{\ListPartii}}\!\!
&= \; \xintListWithSep{+}{\xintApply{\macroFraccdot}{\LBreakVari}}\!\!
&\quad + \; \xintListWithSep{+}{\xintApply{\macroFraccdot}{\LBreakVarii}}\!\!
&= \; \macroFrac{\sigma\_LP} \; \approx \; \np{\xintDecToString{\xintREZ{\xinttheiexpr[3] \sigma\_LP \relax}}}{
\quad \rightarrow \quad
\sigma = \sqrt{\text{Var}(X)} \;
\approx \; \np{\xintDecToString{\xintREZ{\xinttheiexpr[3] \text{reduce}(\sqrt{\sigma\_LP}) \relax}}}{
\end{align*}

```

1.4 Histogramme



```

%% Defining the values for the "expected value" ready made for PSTricks (both PS way and TeX way)
\def\muePS{\xintDecToString{\xintREZ{\xinttheiexpr[6]mue_LP\relax}}}
\def\mueFr{\xintSignedFrac{\xinttheiexpr[mue_LP\relax]}

%% Bar plot
\begin{pspicture}(-1,0)(13,8)
\psgrid[subgriddiv=1,gridlabels=0,gridwidth=0.4pt](0,0)(13,8)
\uput[r](13,0){ $x$ }
\listplot[plotstyle=bar,barwidth=1.0cm,yunit=40,fillstyle=solid,fillcolor=cyan,opacity=0.75]{\LPPST}
\psaxes[ticksiz=0.5pt,tickstyle=inner,Dy=0.025,dy=1,comma]{->}(0,0)(-0.25,0)(13,8)
\psline[linestyle=dashed,linecolor=magenta,linewidth=1.5pt](\muePS,-0.2)(\muePS,6.9)
\uput[-90](\muePS,-0.3){\textcolor{magenta}{ $\mu=\mueFr$ }}
\end{pspicture}

```