

Using R, LaTeX and Wiki for an Arabic e-learning platform

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e-Learning

- Online education framework.
- Web-based teaching materials
- Complement to classical learning.
- Tools for e-learning
 - ▶ Internet
 - ▶ Computer-based
 - ▶ Audio
 - ▶ Video
 - ▶ Videoconferencing



- Effective education is a necessity.
- Institute for statistics and econometrics of Humboldt-University-Berlin offered more projects in e-learning
 - ▶ MM*Stat
 - ▶ e-stat
 - ▶ Electronic books
 - ▶ Moodle
 - ▶ Statwiki



- Statistics is the field that can profit a lot from e-learning/e-teaching standards.
- Arabic e-learning platform in statistics could not be found.
- We have done on the development of an Arabic e-learning platform in statistics (Arabic MM*Stat).
- Arabic MM*Stat was built through Wiki Technology.



Outline

1. Motivation ✓
2. Difficulties to design Arabic platforms in Statistics.
3. WiKi Technology.
4. Arabic MM*Stat.
5. Integrate LaTeX into Arabic MM*Stat.
6. Integrate R program through Wiki into Arabic MM*Stat.
7. Conclusion.

Difficulties to design Arabic platforms in statistics

There are many problems associated with the making of an Arabic platform, these relate to language, culture and technology.

- Language problems
 - ▶ The writing in Arabic is from right to left.
 - ▶ The translation.
- Culture problems
 - ▶ Interest rates.
 - ▶ The prohibition of alcohol.
- Technology problems
 - ▶ ArabTeX works difficulty with LaTeX.
 - ▶ The interactive examples in Arabic e-learning platform.
 - ▶ E-learning market.
 - ▶ Internet services.



- Therefore we propose the Wiki technology as a solution to these problems.
 - ▶ Wiki supports the solutions for language problems.
 - ▶ Wiki is an easy tool to create web page.
 - ▶ Wiki supports LaTeX and other statistical programs, for instance R.



WiKi Technology

What is Wiki ?

- Wiki is a system program that allows users to collaborate in forming the content of a web site.
- The first web site in Wiki, WikiWikiWeb was designed by Ward Cunningham and Bo Leuf in 1995.
- Wiki is a simple database that can operate on the World Wide Web.
- The goal is to simplify the process of participation and cooperation in the development of content with maximum flexibility.



Why Wiki?

- Wiki uses simple markup rules.



Figure 1: Edit page in Wiki



- The Wiki website keeps the old copies of our pages.
- Wiki are fully editable, everyone who reads the Wiki, can work on the pages and provide new pages.
- Most Wiki site require no registration and therefore contents editing by users is open.



Application of Wiki:

- One can use Wiki in several ways:
 - ▶ At universities.
 - ▶ Educational institutes.
 - ▶ In companies.
 - ▶ And specialized web sites.
- Many examples of web sites dependent on Wiki as tool for the development of the contents.
 - ▶ like Wikipedia, <http://en.wikipedia.org>
 - ▶ <http://teachwiki.wiwi.hu-berlin.de>
 - ▶ There is Arabic e-learning platform in Wiki.
<http://wiki.arabeyes.org>



MM*Stat

- MM*Stat was developed at the School for Business and Economics of Humboldt-University-Berlin(Rönz,Müller, Ziegenhagen 2000).
- HTML based multimedia environment.
- Filing-card structure.
- Generated with LaTeX.
- Contents:
 - ▶ Lectures
 - ▶ Examples, multiple choice questions
 - ▶ Interactive examples
 - ▶ Additional information
- Available online at:
<http://www.quantlet.com/mdstat/products.html>



http://www.quantlet.com - M M * S t a t - Microsoft Internet Explorer

lecture: information explained enhanced enhanced interactive
6.4 6.4 6.4 6.4 6.4 6.4

6.4 Hypergeometric Distribution

The Hypergeometric distribution is based on a **random event** with the following characteristics:

- total number of elements is N
- from the N elements, M elements have the property $N-M$ elements do not have this property, i.e. only two **events**, A and \bar{A} are possible
- we randomly choose n elements out of the N

This means the **probability** $P(A)$ is not constant and the draws (events) are not independent in this sort of experiment.

The **random variable** X , which contains number of successes A after n repetitions of the experiment has a Hypergeometric distribution with parameters N, M , and n , with **probability density function**:

$$f_H(x; N, M, n) = \begin{cases} \frac{\binom{M}{x} \cdot \binom{N-M}{n-x}}{\binom{N}{n}} & \text{for } x = \max[0, n - (N - M)], \dots, \min[n, M] \\ 0 & \text{otherwise} \end{cases}$$

Shorthand notation is: $X \sim H(N, M, n)$.

The **expected value** and the **variance** of the Hypergeometric distribution $H(N, M, n)$:

Navigation icons: Home, Contents, Search, Information, Explained, Enhanced, Enhanced, Interactive.

Figure 2: Standardization is via an HTML filing card system

Arabic MM*Stat

- The basic frame for this platform, the system MM*Stat.
- Arabic MM*Stat will be the first developed platform for Arab users in statistics.
- It is applied in the following web page.
<http://pluto.wiwi.hu-berlin.de/mediawiki/index.php>.



التوزيع الطبيعي

التوزيع الطبيعي التفاضلي للتوزيع الطبيعي المتعدد المتغيرات للتوزيع الطبيعي

6.7 التوزيع الطبيعي

بروز المعيار العشوائي للمتغير X توزيعاً طبيعياً مع المتوسط μ و σ ، ويشكل له $X \sim N(\mu, \sigma)$ إذا وفقط إذا تابع لتناقص الاحتمال:

$$f_N V(x; \mu, \sigma) = \frac{1}{\sigma\sqrt{2\pi}} e^{-(x-\mu)^2/2\sigma^2} \quad -\infty < x < +\infty, \sigma > 0$$

تابع التوزيع له:

$$F_N V(x; \mu, \sigma) = \frac{1}{\sigma\sqrt{2\pi}} \int_{-\infty}^x e^{-(t-\mu)^2/2\sigma^2} dt$$

يشهد التوزيع الطبيعي على المتغيرين μ و σ ، أي القيمة المتوقعة والانحراف المعياري للمتغير العشوائي X نظرية المتوقعة، التباين و الانحراف المعياري

$$E(X) = \mu = \int_{-\infty}^{+\infty} x f(x) dx, \quad Var(X) = \sigma^2 = \int_{-\infty}^{+\infty} (x - \mu)^2 f(x) dx, \quad \sigma = \sqrt{\sigma^2}$$

Figure 3: Graphical user interface (GUI) of Arabic MM*Stat in Wiki

Implemented Wiki into Arabic MM*Stat

- Editing pages.
- Adding pictures and graphics.
- Addition the internal and external links to Arabic MM*Stat.
- Addition variables and statistical formulas.
- The making of the tables in Arabic MM*Stat.



تحرير التوزيع التكراري للبيانات المستمرة

Warning: You are not logged in. Your IP address will be recorded in this page's edit history

```

<TABLE CELLSPACING="3" BORDER="1">
<TR><TD ALIGN="RIGHT">المصدر الرئيسي</TD><TD ALIGN="RIGHT">مصدر البيانات</TD></TR>
<TR><TD ALIGN="LEFT">أحدث التغييرات</TD><TD ALIGN="LEFT">مساحة بحثية</TD></TR>
<TR><TD ALIGN="RIGHT">مساعدة</TD><TD ALIGN="RIGHT">القرارات</TD></TR>
</TABLE>
[[mmeng]avaimg96.gif:صورة</TD>
<TD ALIGN="RIGHT">
[[mmeng]avaimg91.gif:صورة</TD>
<TD ALIGN="LEFT">
[[mmeng]avaimg139.gif:صورة</TD>
<TR>
<TD ALIGN="RIGHT">
[[mmeng]avaimg96.gif:صورة</TD>

```

Please note that all contributions to Wiki are considered to be released under the GNU Free Documentation License 1.2 (see Wiki for details). If you don't want your name to be added, you should not edit it, or if you don't edit it here.

Figure 4: Edit table in Arabic MM*Stat using HTML



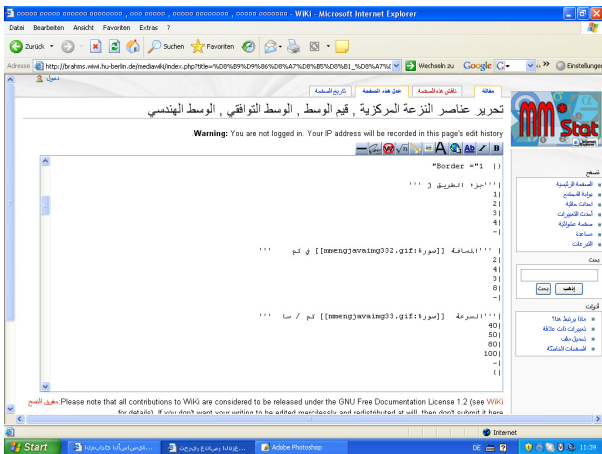


Figure 5: Edit table in Arabic MM*Stat using Wiki



Integrate LaTeX into Arabic MM*Stat

- LaTeX is a document preparation system for high-quality typesetting.
- It is most often used for medium-to-large technical or scientific documents.
- ArabTeX is a LaTeX-package for typesetting Arabic.
- ArabTeX is a free, though copyrighted, package developed by Professor Klaus Lagally of Stuttgart University (1993).



```

\documentstyle[12pt,arabtex]{article}
\begin{document}

\setarab % choose the language conventions
\vocalize % diacritics for short vowels on
\transtrue % additionally switch on the transliteration
\arabtrue % print arabic text ... is on anyway
\spreadtrue % spread out caption

\centerline {<'gu.ha wa-.himAruhu>}

\begin{arabtext}
'at_A .sadiquW 'il_A `gu.hA ya.tlubu minhu .himAruhu li-yarkabahu
fi safratiH qa.sIraTiH wa-qAla lahu:

sawfa 'u'Iduhu 'ilayka fi al-masA'i, wa-'adfa'u laka 'u'graTan. \\\
fa-qAla `gu.hA:

'anA 'Asifun `giddal' annI lA 'asta.tI'u 'an 'u.haqqiqa
laka ra.gbataka, fa-al.himAru laysa hunA al-yawma. \\\
wa-qabla 'an yutimmu `gu.hA kalAmahu
bada'a al-.himAru yanhaqu fi i.s.tablihi. \\\
fa-qAla lahu .sadiquhu:

'inni 'asma'u .himAraka ya `gu.hA yanhaqu. \\\
fa-qAla lahu `gu.hA:

.garibuW 'amruka ya .sadiqi!
'a-tu.saddiqu al-.himAra wa-tuka_d_dibunI?
\end{arabtext}

\end{document}

```

وَجَاهُ وَجَاهُهُ wa-ḥimāruhu

'atā ṣadiqun 'ilā ḡuhā yaṭlubu minhu ḥimāruhu li-yarkabahu fi safratin qaṣīratin wa-qāla lahu:

أَنَا صَدِيقٌ إِلَى جَاهُ يَطْلُبُ مِنِّي جَاهَهُ لِيَرْكَبَهُ فِي سَفَرَةٍ قَصِيرَةٍ وَقَالَ لَهُ :

sawfa u'iduhu 'ilayka fi 'l-masā'i, wa-'adfa'u laka 'u'gratan.

سَوْفَ أُعِيدُهُ إِلَيْكَ فِي الْمَسَاءِ ، وَأَدْفَعُ لَكَ أِجْرَةً .

fa-qāla ḡuhā:

فَقَالَ جَاهُ :

'anā 'āsifun ḡiddan 'anni lā 'astati'u 'an 'uḥaqqiqa laka raḡbataka, fa-'lhimāru laysa hunā 'l-yawma.

أَنَا آسِيفٌ جِدًّا أَنِّي لَا أَسْتَطِيعُ أَنْ أَحَقِّقَ لَكَ رَغْبَتَكَ ، فَالْحِمَارُ لَيْسَ هُنَا الْيَوْمَ .

wa-qabla 'an yutimmu ḡuhā kalāmahu bada'a 'l-ḥimāru yanhaqu fi 'ṣablihi.

وَقَبْلَ أَنْ يُتِمَّ جَاهُ كَلَامَهُ بَدَأَ الْحِمَارُ يَنْهَقُ فِي أَصْلَبِهِ .

fa-qāla lahu ṣadiquhu:

فَقَالَ لَهُ صَدِيقُهُ :

'inni 'asma'u ḥimāraka yā ḡuhā yanhaqu.

إِنِّي أَسْمَعُ جِمَارَكَ يَا جَاهُ يَنْهَقُ .

fa-qāla lahu ḡuhā:

فَقَالَ لَهُ جَاهُ :

ḡarībun 'amruka yā ṣadiqi! 'a-tuṣaddiqu 'l-ḥimāra wa-tukaddibunī?

غَرِيبٌ أَمْرُكَ يَا صَدِيقِي ! أَتُصَدِّقُ الْحِمَارَ وَتُكْذِبُنِي ؟

Figure 6: Leftpanel: Sample Arabtex input in LaTeX, right panel: Sample Arabtex output in LaTeX



- Wiki supports LaTeX to writing the complex statistical forms into Arabic MM*Stat.
- Integration of LaTeX
 - ▶ $\langle \mathit{math} \rangle \dots \langle /\mathit{math} \rangle$
 - ▶ As graphics:
 $\langle \mathit{math} \rangle E(X + Y) = E(X) + E(Y) \langle /\mathit{math} \rangle$

المعلومات الإضافية لتطبيقات طريقة الإمكانية العظمى

المعلومات الإضافية لتطبيقات طريقة الإمكانية العظمى

نظروا الإمكانية العظمى التي هي $L(\mu, \sigma^2 | x_1, \dots, x_n)$ مع توزيع غاوسي

نظروا للمعلمة العشوائية X_i ($i = 1, \dots, n$) هي متغير عشوائي مع توزيع غاوسي مع المعلمة المعروفة μ و σ^2

نظروا أن X_1, \dots, X_n هي متغير عشوائي مع توزيع غاوسي مع المعلمة المعروفة μ و σ^2

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$$L(\mu, \sigma^2 | x_1, \dots, x_n) = \prod_{i=1}^n f(x_i | \mu, \sigma) = \left(\frac{1}{\sqrt{2\pi\sigma^2}} \right)^n e^{-\frac{1}{2\sigma^2} \sum_{i=1}^n (x_i - \mu)^2}$$

$$= (2\pi\sigma^2)^{-\frac{n}{2}} \cdot \exp\left(-\frac{1}{2\sigma^2} \sum_{i=1}^n (x_i - \mu)^2\right)$$

نظروا أن X_1, \dots, X_n هي متغير عشوائي مع توزيع غاوسي مع المعلمة المعروفة μ و σ^2

$$\log L(\mu, \sigma^2 | x_1, \dots, x_n) = -\frac{n}{2} \cdot \log(2\pi) - \frac{n}{2} \cdot \log \sigma^2 - \frac{1}{2\sigma^2} \cdot \sum_{i=1}^n (x_i - \mu)^2$$

Figure 7: Using LaTeX into Arabic MM*Stat



Figure 8: Edit case using LaTeX format



Integrate R program through Wiki into Arabic MM*Stat

- R is a language and environment for statistical computing and graphics.
- R was designed by Ross Ihaka and Robert Gentleman at the University of Auckland, New Zealand 1997.
- R provides a wide variety of statistical and graphical techniques:
 - ▶ linear and nonlinear modelling.
 - ▶ classical statistical tests.
 - ▶ time-series analysis.
 - ▶ classification.
 - ▶ clustering.
- R is available as Free Software.



- R will be integrated into Wiki.
- Two new Tags
 - ▶ `< R > ... < /R >`
 - ▶ `< Rform > ... < /Rform >`



- The Mediawiki is the software behind the Wikipedia.
- This extension allows to run R programs within the Mediawiki and to display:
 - ▶ Tables
 - ▶ Graphical output
 - ▶ Interactive examples
- Information and Download: (Dr. Sigbert Klinke)
<http://mars.wiwi.hu-berlin.de/mediawiki/sk/index.php/R-Plugin-for-MediaWiki>



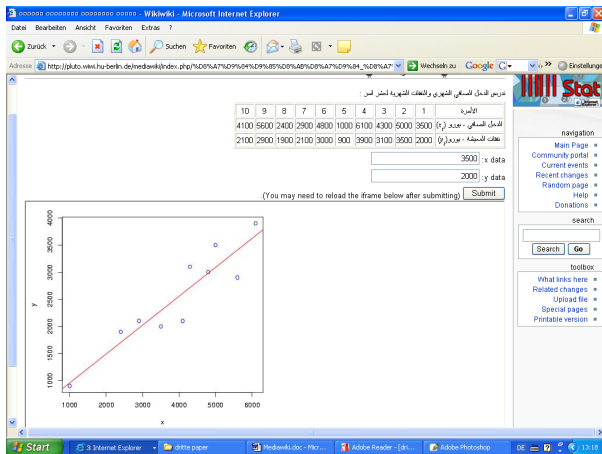


Figure 9: The interactive example for linear regression.

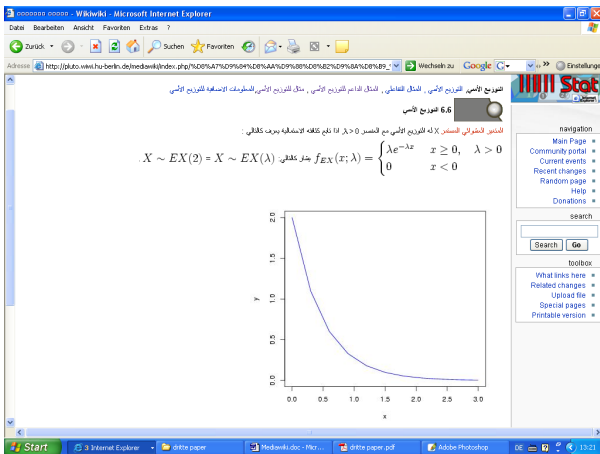


Figure 10: The probability function of an exponential distribution.

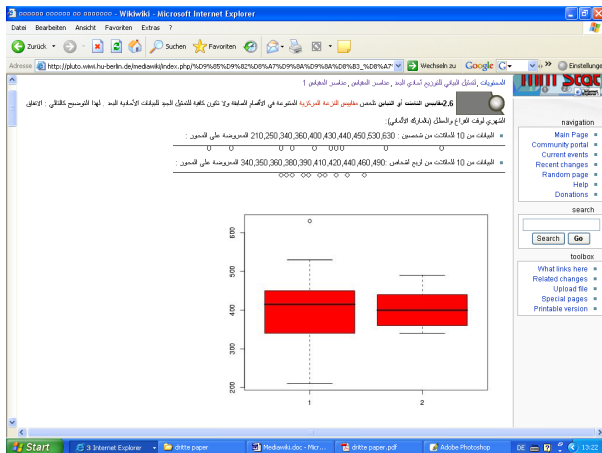


Figure 11: Boxplot for measures of scale.

Conclusion

- There is the possibility of creating an e-learning system with Arabic MM*Stat through the application of Wiki technology.
- Rwiki is the solution for the interactive examples in Arabic MM*Stat.
- LaTeX is the solution to writing the complex statistical forms into Arabic MM*Stat.
- You are welcome to contribute to Arabic MM*Stat!

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