Generating Random Performance Tableaux

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Motivation

- Provide random instances of performance tableaux for MCDA Web services testing and debugging
- Illustrate the use of `xmcda:methodOptions` in XMCDA-2.0
- Show a new XMCDA-2.0 service offered on the D3 server in Luxembourg.

Outline

Random Performance Tableaux
1.1 Standard reference model
1.2 random performance generators
1.3 random thresholds

Special Performance Tableaux
2.1 Cost-Benefit performance Tableaux
2.2 Correlating the performances with three coalitions
2.3 Introducing random coalitions

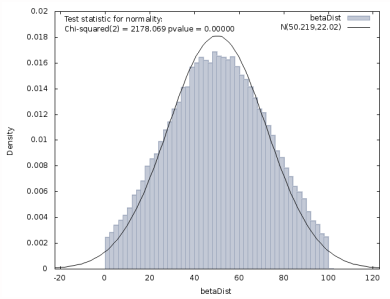
Ramdom Performance Tableau

Definition (A reference model)

- 20 decision actions; low variant: 13; high variant: 50.
- 13 criteria; low variant: 7; high variant: 20.
- All criteria are equi-significant.
- All criteria use a same cardinal scale from 0.0 to 100.0.
- Four random performance generators may be used:
  - a uniform generator ($\mathcal{U}(0.0, 100)$),
  - a truncated normal generator ($\mathcal{N}(\mu, \sigma)$),
  - a triangular generator ($\mathcal{T}(xm, r)$) with mode xm and probability repartition r,
  - a beta generator ($\mathcal{B}eta(xm, s)$) with mode xm and standard deviation s.

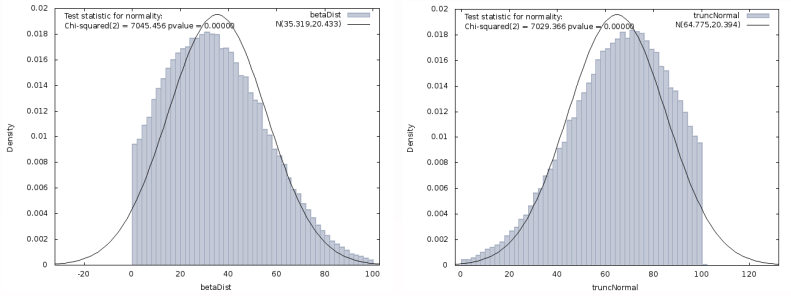
Truncated Normal Generator

- In the reference case, the mode xm is situated in the middle (50.0) of the performance scale and the standard deviation is a fourth (25) of the scale scope.



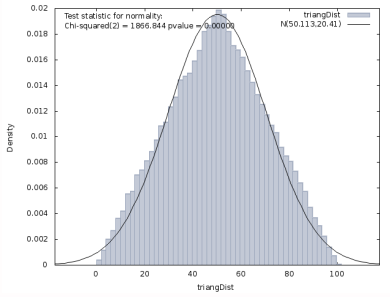
Truncated Normal Generator (continued)

- We consider two variants:
  - low performances: $xm = 30$,
  - high performances: $xm = 70$,



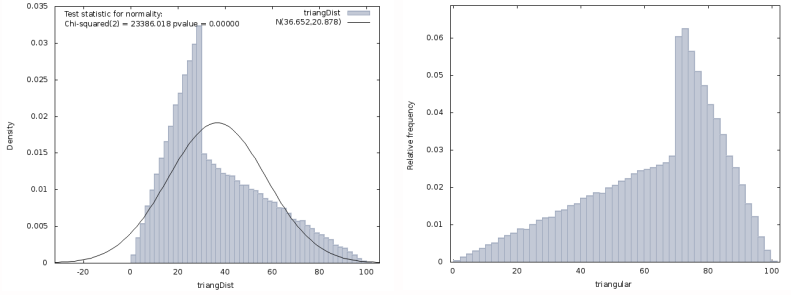
Triangular Generator

- In the reference case, the mode xm is situated in the middle (50.0) of the performance scale and the probabilty is equally distributed on both sides, i.e. $r = 0.5$ and xm represents the median performance.



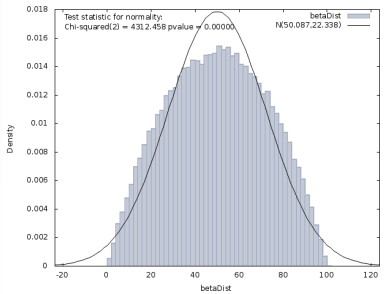
Triangular Generator (continued)

- We consider two variants with fixed repartition $r = 0.5$:
  - low performances: $xm = 30$,
  - high performances: $xm = 70$,



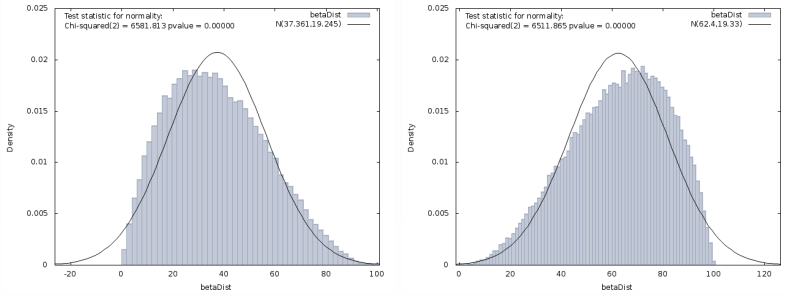
Beta Generator

- In the reference case, the mode xm is situated in the middle (50.0) of the performance scale and the probabilty is equally distributed on both sides, i.e. xm represents the median performance.



Beta Generator (continued)

- We consider two variants with equal standard deviation:
  - low performances: $xm = 30$,
  - high performances: $xm = 70$,



Fixed Discrimination Thresholds

On each criterion, the default discrimination thresholds are chosen such that the:

- indifference threshold equals 5.0 (low: 2.5, high:10.0);
- preference threshold equals 15.0 (low: 10.0, high:20.0);
- weak veto threshold equals 70.0 (low: 60.0, high: 80);
- veto threshold equals 80.0 (low: 70.0, high: 90).

- The ordinal criteria admit solely a preference threshold of one unit.

Example

Random performance tableau instance

Fixed Percentile Discrimination Thresholds

On each criterion, the default discrimination thresholds are chosen such that the:

- indifference threshold equals the percentile 5 of all generated performance differences;
- preference threshold equals the percentile 10 of all generated performance differences;
- weak veto threshold equals the percentile 90 of all generated performance differences;
- veto threshold equals the percentile 95 of all generated performance differences.

- The ordinal criteria admit solely a preference threshold of one unit.

Example

Random performance tableau instance

Ramdom Cost-Benefit Performance Tableau

Definition (A reference model)

- 20 decision actions; low variant: 13; high variant: 50.
- 13 criteria; low variant: 7; high variant: 20.
- A criteria is with equal probability either to be minimized (cost criteria) or to be maximized (benefit criteria).
- All criteria either support an ordinal or a cardinal performance scale; the cost criteria being mostly cardinal (2/3) and the benefit ones mostly ordinal (2/3).
- Ordinal performances are represented on integer scales: $\{1, 2, ..., 10\}$.
- Cardinal performances are represented on a decimal scale: $[0.0; 100.0]$ with a precision of 2 digits.

Random Cost-Benefit Performance Tableau (continued)

- In the Cost-Benefit model the decision actions are divided randomly into three categories: *cheap*, *neutral*, *advantageous*.
- An action is called:
  - cheap when the performances are generated with $\mathcal{T}(xm = 30, r = 0.5)$ (reference) or $\mathcal{N}(\mu = 30, \sigma = 25)$.
  - advantageous when the performances are generated with $\mathcal{T}(xm = 70, r = 0.5)$ (reference) or $\mathcal{N}(\mu = 70, \sigma = 25)$,
  - and neutral when the performances are generated with $\mathcal{T}(xm = 50, r = 0.5)$ (reference) or $\mathcal{N}(\mu = 50, \sigma = 25)$.

Example

Random performance tableau instance

Correlating the performances with three coalitions

- In a first case we consider three a priori coalitions: A,B and C.
- Every criteria is affected randomly to one of the three coalitions.
- Each actions is randomly affected on each coalition to one of three performance following categories: low performance (-), medium performance ($\sim$) and high performance ($+$).
- When generating the performances af an alternative on a criterion, the random generator is modulated following the prerformance profile of the action respective to the coalition of the criterion.

Example

Random performance tableau instance

Random Criteria Coalitions

- We consider a family of n criteria.
- Every criteria is affected randomly to one of n potential coalitions.
- Each actions is randomly affected on each coalition to one of three performance categories: low performance (-), medium performance ($\sim$) and high performance ($+$).
- When generating the performances af an alternative on a criterion, the random generator is modulated following the prerformance profile of the action respective to the coalition of the criterion.

Example

Random performance tableau instance

Concluding Remarks

In this communication we have presented:

- A reference model for random performance tableaux
- Four generators for random performances
- An parametric XMCDA-2.0 Web service for random performance tableaux.

Motivation Random Performance Tableaux Special Performance Tableaux Conclusion

References I

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