Unit 8 Seminar Preparation

Quantitative Risk Modelling

Please carry out this activity before joining the seminar this week. Your answers will be discussed during the seminar.

Activity

Part A

Read Goerlandt et al (2017), Hugo et al (2018) and Çelikbilek & Tüysüz (2020) and answer the following questions:

1. How do Goerlandt et al (2017) suggest that the validity of QRA approaches can be validated? What did they posit was the most effective approach?
2. Which techniques did Hugo et al (2018) [recommend] should be applied to project management? What were their recommendations to increase the use of QR analysis in Projects?
3. The last paper reviews various Multi-criteria decision methods (MCDMs) and considered the relative accuracy and validity of the techniques. Which did they find was the most accurate of the methods compared? What were the failings of the general TOPSIS approach?

Part B

Read chapter 5 of the course text (Olsen & Desheng (2020)) and implement the inventory Monte Carlo simulation. You can use Yasai (Eckstein & Riedmuller, 2002) to replace crystal ball. (If you have difficulty implementing the course text model, there is a simplified model also available). Their paper gives instructions on its use. Be prepared to discuss your results in the seminar.

You should add your answers to your e-portfolio and be prepared to discuss them as part of this week's seminar.

Part A

1. Goerlandt et al. (2017):

- The following methods can be used to validate QRA approches:
  - pragmatic validity:
    - complete benchmark exercise
      - “comparison with a complete parallel analysis of the same system or activity” (131)
        - Ammonia storage facility, virtual hydrogen refuelling station, ship-ship collision
    - partial benchmark exercise

        - "comparison with a parallel analysis on some parts of the same system or activity" (ibid)
    - reality check
        - "comparison with operating experience of corresponding systems" (ibid)
            - hazard and operability study (HAZOP)
                - most successful
            - action error analysis (AEA)
            - failure mode and effect analysis (FMEA)
            - management oversight and risk tree (MORT)
                - least successful
    - independent peer review
        - "examination of the output of the risk analysis by a (range of) technical expert(s)" (ibid)
            - criteria include:
                - constraints
                - data collection
                - key factors
                - assumptions
                - methodologies
                - transparency
                - sensitivity
                - results
                - conclusions and recommendations
            - "a two-stage Bayesian QRA framework" (133)
    - quality assurance
        - "examination of the process behind the analysis." (131)
            - model use and implications
                - practical validity
            - model per se
                - translation and criterion validity
            - value-related validity
                - uncertainty and stake-holder validity
            - Process
            - procedural validity
- The authors found quality assurance to be most likely to improve QRA

2. Hugo et al. (2018):
- Tools mentioned:
    - Monte Carlo simulation
    - Likert Scale
- The following should be done to improve tool use:
    - "Improve individuals' risk management competence via training, exposure, etc.
    - Align the parent organisation's approach to risk management with projects, and strive to improve the organisation's maturity levels in project and risk management processes.
    - Make available the required resources, both human and software, to carry out risk management, both for qualitative and quantitative risk management." (127)

3. Çelikbilek & Tüysüz (2020):

- Most accurate methods used:
  - AHP
  - Viktor
  - Moora
- Failings of general TOPSIS approach:
  - “Euclidean space assumptions
  - Euclidean distance calculations
  - Ranking index” (298)

Part B

Monte Carlo was adapted from https://www.youtube.com/watch?v=oUwX-JrAfVE for use in Libreoffice without Yasai.

	A	B	C	D	E	F	G	H	I	J
1		Demand	Units Sold	End Inv						
2	Expected	$4,503	4,467	3,521						
3	Std	$75	138	2,317					Mean Profit	=AVERAGE(F5:F3000)
4						Net Profit			Std. Dev	=STDEV(F5:F3000)
5	1st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B5-C5-D5			Min Proft	=MIN(F5:F3000)
6	2st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B6-C6-D6			Max	=MAX(F5:F3000)
7	3st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B7-C7-D7			Risk of Loss	=COUNTIF(F5:F3000,"<0")/500
8	4st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B8-C8-D8				
9	5st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B9-C9-D9				
10	6st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B10-C10-D10				
11	7st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B11-C11-D11				
12	8st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B12-C12-D12				
13	9st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B13-C13-D13				
14	10st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B14-C14-D14				
15	11st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B15-C15-D15				
16	12st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B16-C16-D16				
17	13st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B17-C17-D17				
18	14st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B18-C18-D18				
19	15st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B19-C19-D19				
20	16st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B20-C20-D20				
21	17st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B21-C21-D21				
22	18st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B22-C22-D22				
23	19st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B23-C23-D23				
24	20st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B24-C24-D24				
25	21st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B25-C25-D25				
26	22st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B26-C26-D26				
27	23st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B27-C27-D27				
28	24st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B28-C28-D28				
29	25st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B29-C29-D29				
30	26st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B30-C30-D30				
31	27st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B31-C31-D31				
32	28st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B32-C32-D32				
33	29st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B33-C33-D33				
34	30st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B34-C34-D34				
35	31st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B35-C35-D35				
36	32st simulation	=NORM.INV(RAND(),B2,B3)	=NORM.INV(RAND(),C2,C3)	=NORM.INV(RAND(),D2,D3)		=B36-C36-D36				

	A	B	C	D	E	F	G	H	I	J
1		Demand	Units Sold	End Inv						
2	Expected	$4,503	4,467	3,521						
3	Std	$75	138	2,317					Mean Profit	-3413.67729706499
4						Net Profit			Std. Dev	2338.78130489453
5	1st simulation	4,547	4,580	4,767		-4,800			Min Proft	-10202.3771767544
6	2st simulation	4,504	4,488	4,967		-4,951			Max	2408.03608390486
7	3st simulation	4,651	4,682	3,469		-3,499			Risk of Loss	0.916
8	4st simulation	4,505	4,458	5,296		-5,249				
9	5st simulation	4,549	4,389	5,487		-5,328				
10	6st simulation	4,451	4,496	4,328		-4,373				
11	7st simulation	4,584	4,460	3,974		-3,849				
12	8st simulation	4,496	4,388	3,703		-3,594				
13	9st simulation	4,667	4,532	2,076		-1,941				
14	10st simulation	4,438	4,589	2,504		-2,655				
15	11st simulation	4,355	4,418	1,874		-1,936				
16	12st simulation	4,571	4,520	1,854		-1,803				
17	13st simulation	4,427	4,457	7,228		-7,257				
18	14st simulation	4,550	4,174	3,819		-3,443				
19	15st simulation	4,436	4,377	3,174		-3,115				
20	16st simulation	4,403	4,547	1,701		-1,844				
21	17st simulation	4,628	4,247	3,115		-2,735				
22	18st simulation	4,514	4,445	5,422		-5,353				
23	19st simulation	4,592	4,117	1,015		-540				
24	20st simulation	4,394	4,489	2,528		-2,622				
25	21st simulation	4,551	4,604	4,514		-4,567				
26	22st simulation	4,496	4,360	725		-589				
27	23st simulation	4,468	4,380	-232		320				
28	24st simulation	4,603	4,186	4,303		-3,886				
29	25st simulation	4,619	4,368	3,230		-2,980				
30	26st simulation	4,508	4,216	4,989		-4,697				
31	27st simulation	4,518	4,629	-552		441				
32	28st simulation	4,574	4,387	2,128		-1,941				
33	29st simulation	4,526	4,298	6,442		-6,214				
34	30st simulation	4,474	4,426	6,521		-6,472				
35	31st simulation	4,377	4,591	4,504		-4,718				
36	32st simulation	4,484	4,587	859		-962				

References:

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