**Unit 8 Preparation A:**

**Goerlandt et al. (2017)** suggest that the validity of Quantitative Risk Analysis (QRA) approaches can be assessed through several methods, including empirical validation (comparing results to real-world data), theoretical validation (ensuring the model accurately represents risk scenarios), and methodological validation (evaluating the model's assumptions). Among these, **empirical validation**, where QRA predictions are compared against observed incidents or real-life data, is posited as the most effective approach. They argue that reality checks provide the most direct evidence of a model's validity, especially when combined with peer review and quality assurance frameworks (UAntwerpen Repository)& (TU Delft Repository).

**Hugo et al. (2018)** focus on the integration of risk analysis techniques into project management. They advocate for the use of probabilistic risk assessments and recommend specific tools like Monte Carlo simulations to manage project risks more effectively. To increase the adoption of QR analysis in project management, they suggest improving accessibility and understanding of these tools through better training and user-friendly software, as well as embedding risk management as a core part of the project lifecycle.

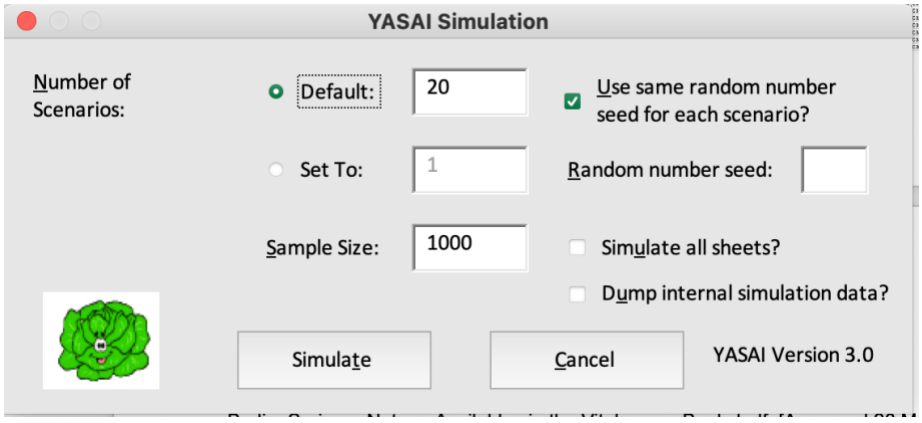
In the final study, **Çelikbilek & Tüysüz (2020)** review various Multi-Criteria Decision Methods (MCDMs) and find that **the Analytic Hierarchy Process (AHP)** generally outperforms other methods in terms of accuracy for decision-making. They criticize the **TOPSIS** method for being overly sensitive to the choice of criteria weights and for its potential to give misleading rankings when alternatives are closely clustered, which undermines its reliability in some applications.

**Preparation 8 B:**

Read chapter 5 of the course text Olsen & Desheng (2020)[1] and implement the inventory Monte Carlo simulation. You can use Yasai (Eckstein & Riedmuller, 2002) to replace crystal ball.

Yasai was installed with the following user guide: https://sites.rutgers.edu/yasai/user-guide/

**Simulation Run:**



| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Holdrate | 0,8 | | ROP | =simParameter({80\100\120\140};"ROP";1) | | | | | | |
| Orderrate | 300 | | Q | =simParameter({100\110\120\130\140};"Q";2) | | | | | | |
| Purchase | 90 | | | | | Net | =simOutput(J5-I5-H5-G5-{K3*B4 | | =simOutput(SUM(K7:K36);"Short") | |
| Sell | 130 | | | | | | | | | |
| | | | | | | =SUM(G7:G36) | =SUM(H7:H36) | =SUM(I7:I36) | =SUM(J7:J36) | |
| Day | Start | Demand | Sales | End | Order | Holdcost | Ordercost | Purchase | Revenue | SHORT |
| 1 | 100 | 85 | =IF(C7>B7; B7; C7) | =B7-C7 | =IF(E7>$E$1;0;$E$2) | =E7*$B$1 | =IF(F7>0;$B$2;0) | =F7*$B$3 | =D7*$B$4 | =IF(C7>B7;C7-B8;0) |
| 2 | =E7+F7 | =INT(genNormal(100;1 | =IF(C8>B8; B8; C8) | =B8-C8 | =IF(E8>$E$1;0;$E$2) | =E8*$B$1 | =IF(F8>0;$B$2;0) | =F8*$B$3 | =D8*$B$4 | =IF(C8>B8;C8-B9;0) |
| 3 | =E8+F8 | =INT(genNormal(100;1 | =IF(C9>B9; B9; C9) | =B9-C9 | =IF(E9>$E$1;0;$E$2) | =E9*$B$1 | =IF(F9>0;$B$2;0) | =F9*$B$3 | =D9*$B$4 | =IF(C9>B9;C9-B10;0) |
| 4 | =E9+F9 | =INT(genNormal(100;1 | =IF(C10>B10; B10; C10) | =B10-C10 | =IF(E10>$E$1;0;$E$2) | =E10*$B$1 | =IF(F10>0;$B$2;0) | =F10*$B$3 | =D10*$B$4 | =IF(C10>B10;C10-B11;0) |
| 5 | =E10+F10 | =INT(genNormal(100;1 | =IF(C11>B11; B11; C11) | =B11-C11 | =IF(E11>$E$1;0;$E$2) | =E11*$B$1 | =IF(F11>0;$B$2;0) | =F11*$B$3 | =D11*$B$4 | =IF(C11>B11;C11-B12;0) |
| 6 | =E11+F11 | =INT(genNormal(100;1 | =IF(C12>B12; B12; C12) | =B12-C12 | =IF(E12>$E$1;0;$E$2) | =E12*$B$1 | =IF(F12>0;$B$2;0) | =F12*$B$3 | =D12*$B$4 | =IF(C12>B12;C12-B13;0) |
| 7 | =E12+F12 | =INT(genNormal(100;1 | =IF(C13>B13; B13; C13) | =B13-C13 | =IF(E13>$E$1;0;$E$2) | =E13*$B$1 | =IF(F13>0;$B$2;0) | =F13*$B$3 | =D13*$B$4 | =IF(C13>B13;C13-B14;0) |
| 8 | =E13+F13 | =INT(genNormal(100;1 | =IF(C14>B14; B14; C14) | =B14-C14 | =IF(E14>$E$1;0;$E$2) | =E14*$B$1 | =IF(F14>0;$B$2;0) | =F14*$B$3 | =D14*$B$4 | =IF(C14>B14;C14-B15;0) |
| 9 | =E14+F14 | =INT(genNormal(100;1 | =IF(C15>B15; B15; C15) | =B15-C15 | =IF(E15>$E$1;0;$E$2) | =E15*$B$1 | =IF(F15>0;$B$2;0) | =F15*$B$3 | =D15*$B$4 | =IF(C15>B15;C15-B16;0) |
| 10 | =E15+F15 | =INT(genNormal(100;1 | =IF(C16>B16; B16; C16) | =B16-C16 | =IF(E16>$E$1;0;$E$2) | =E16*$B$1 | =IF(F16>0;$B$2;0) | =F16*$B$3 | =D16*$B$4 | =IF(C16>B16;C16-B17;0) |
| 11 | =E16+F16 | =INT(genNormal(100;1 | =IF(C17>B17; B17; C17) | =B17-C17 | =IF(E17>$E$1;0;$E$2) | =E17*$B$1 | =IF(F17>0;$B$2;0) | =F17*$B$3 | =D17*$B$4 | =IF(C17>B17;C17-B18;0) |
| 12 | =E17+F17 | =INT(genNormal(100;1 | =IF(C18>B18; B18; C18) | =B18-C18 | =IF(E18>$E$1;0;$E$2) | =E18*$B$1 | =IF(F18>0;$B$2;0) | =F18*$B$3 | =D18*$B$4 | =IF(C18>B18;C18-B19;0) |
| 13 | =E18+F18 | =INT(genNormal(100;1 | =IF(C19>B19; B19; C19) | =B19-C19 | =IF(E19>$E$1;0;$E$2) | =E19*$B$1 | =IF(F19>0;$B$2;0) | =F19*$B$3 | =D19*$B$4 | =IF(C19>B19;C19-B20;0) |
| 14 | =E19+F19 | =INT(genNormal(100;1 | =IF(C20>B20; B20; C20) | =B20-C20 | =IF(E20>$E$1;0;$E$2) | =E20*$B$1 | =IF(F20>0;$B$2;0) | =F20*$B$3 | =D20*$B$4 | =IF(C20>B20;C20-B21;0) |
| 15 | =E20+F20 | =INT(genNormal(100;1 | =IF(C21>B21; B21; C21) | =B21-C21 | =IF(E21>$E$1;0;$E$2) | =E21*$B$1 | =IF(F21>0;$B$2;0) | =F21*$B$3 | =D21*$B$4 | =IF(C21>B21;C21-B22;0) |
| 16 | =E21+F21 | =INT(genNormal(100;1 | =IF(C22>B22; B22; C22) | =B22-C22 | =IF(E22>$E$1;0;$E$2) | =E22*$B$1 | =IF(F22>0;$B$2;0) | =F22*$B$3 | =D22*$B$4 | =IF(C22>B22;C22-B23;0) |
| 17 | =E22+F22 | =INT(genNormal(100;1 | =IF(C23>B23; B23; C23) | =B23-C23 | =IF(E23>$E$1;0;$E$2) | =E23*$B$1 | =IF(F23>0;$B$2;0) | =F23*$B$3 | =D23*$B$4 | =IF(C23>B23;C23-B24;0) |
| 18 | =E23+F23 | =INT(genNormal(100;1 | =IF(C24>B24; B24; C24) | =B24-C24 | =IF(E24>$E$1;0;$E$2) | =E24*$B$1 | =IF(F24>0;$B$2;0) | =F24*$B$3 | =D24*$B$4 | =IF(C24>B24;C24-B25;0) |
| 19 | =E24+F24 | =INT(genNormal(100;1 | =IF(C25>B25; B25; C25) | =B25-C25 | =IF(E25>$E$1;0;$E$2) | =E25*$B$1 | =IF(F25>0;$B$2;0) | =F25*$B$3 | =D25*$B$4 | =IF(C25>B25;C25-B26;0) |
| 20 | =E25+F25 | =INT(genNormal(100;1 | =IF(C26>B26; B26; C26) | =B26-C26 | =IF(E26>$E$1;0;$E$2) | =E26*$B$1 | =IF(F26>0;$B$2;0) | =F26*$B$3 | =D26*$B$4 | =IF(C26>B26;C26-B27;0) |
| 21 | =E26+F26 | =INT(genNormal(100;1 | =IF(C27>B27; B27; C27) | =B27-C27 | =IF(E27>$E$1;0;$E$2) | =E27*$B$1 | =IF(F27>0;$B$2;0) | =F27*$B$3 | =D27*$B$4 | =IF(C27>B27;C27-B28;0) |
| 22 | =E27+F27 | =INT(genNormal(100;1 | =IF(C28>B28; B28; C28) | =B28-C28 | =IF(E28>$E$1;0;$E$2) | =E28*$B$1 | =IF(F28>0;$B$2;0) | =F28*$B$3 | =D28*$B$4 | =IF(C28>B28;C28-B29;0) |
| 23 | =E28+F28 | =INT(genNormal(100;1 | =IF(C29>B29; B29; C29) | =B29-C29 | =IF(E29>$E$1;0;$E$2) | =E29*$B$1 | =IF(F29>0;$B$2;0) | =F29*$B$3 | =D29*$B$4 | =IF(C29>B29;C29-B30;0) |
| 24 | =E29+F29 | =INT(genNormal(100;1 | =IF(C30>B30; B30; C30) | =B30-C30 | =IF(E30>$E$1;0;$E$2) | =E30*$B$1 | =IF(F30>0;$B$2;0) | =F30*$B$3 | =D30*$B$4 | =IF(C30>B30;C30-B31;0) |
| 25 | =E30+F30 | =INT(genNormal(100;1 | =IF(C31>B31; B31; C31) | =B31-C31 | =IF(E31>$E$1;0;$E$2) | =E31*$B$1 | =IF(F31>0;$B$2;0) | =F31*$B$3 | =D31*$B$4 | =IF(C31>B31;C31-B32;0) |
| 26 | =E31+F31 | =INT(genNormal(100;1 | =IF(C32>B32; B32; C32) | =B32-C32 | =IF(E32>$E$1;0;$E$2) | =E32*$B$1 | =IF(F32>0;$B$2;0) | =F32*$B$3 | =D32*$B$4 | =IF(C32>B32;C32-B33;0) |
| 27 | =E32+F32 | =INT(genNormal(100;1 | =IF(C33>B33; B33; C33) | =B33-C33 | =IF(E33>$E$1;0;$E$2) | =E33*$B$1 | =IF(F33>0;$B$2;0) | =F33*$B$3 | =D33*$B$4 | =IF(C33>B33;C33-B34;0) |
| 28 | =E33+F33 | =INT(genNormal(100;1 | =IF(C34>B34; B34; C34) | =B34-C34 | =IF(E34>$E$1;0;$E$2) | =E34*$B$1 | =IF(F34>0;$B$2;0) | =F34*$B$3 | =D34*$B$4 | =IF(C34>B34;C34-B35;0) |
| 29 | =E34+F34 | =INT(genNormal(100;1 | =IF(C35>B35; B35; C35) | =B35-C35 | =IF(E35>$E$1;0;$E$2) | =E35*$B$1 | =IF(F35>0;$B$2;0) | =F35*$B$3 | =D35*$B$4 | =IF(C35>B35;C35-B36;0) |
| 30 | =E35+F35 | =INT(genNormal(100;1 | =IF(C36>B36; B36; C36) | =B36-C36 | =IF(E36>$E$1;0;$E$2) | =E36*$B$1 | =IF(F36>0;$B$2;0) | =F36*$B$3 | =D36*$B$4 | =IF(C36>B36;C36-B37;0) |

## Output

| Net Sales | Q = 100 | Q = 110 | Q = 120 | Q = 130 | Q = 140 |
|---|---|---|---|---|---|
| **ROP = 80** | 100,944 | 99,777 | 97,696 | 97,172 | 97,295 |
| **ROP = 100** | 101,185 | 103,584 | 103,619 | **103,768** (Highest) | 103,178 |
| **ROP = 120** | 100,727 | 102,042 | 102,209 | 102,057 | 102,030 |
| **ROP = 140** | 100,428 | 100,021 | 99,951 | 99,779 | 100,065 |

**Highest Net Sales** occurs at **ROP = 100** and **Q = 130**, with a value of **103,768**.

**References:**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