Unit 8 seminar preparation - Quantitative risk modelling

Part A

How do Goerlandt et al (2017) suggest that the validity of QRA approaches can be validated?

Can use models or approaches such as:

1. Bayesian QRA modelling framework
2. Reality check
3. Partial benchmark exercise
4. independent peer review
5. complete benchmark exercise

What did they posit was the most effective approach?

Quality assurance has been found effective to reduce the number of deficiencies in QRA studies. Quality assurance rests on the hypothesis that a better process to produce a QRA leads to a better QRA.

Which techniques did Hugo et al (2018) should be applied to project management?

Quantitative risk management

What were their recommendations to increase the use of QR analysis in Projects?

1. Improve individuals' risk management competence via training, exposure, etc.
2. Make available the required resources, both human and software, to carry out risk management, both for qualitative and quantitative risk management.

The last paper reviews various Multi-criteria decision methods (MCDMs) and considers the relative accuracy and validity of the techniques.

Which did they find was the most accurate of the methods compared?

TOPSIS AHP

What were the failings of the general TOPSIS approach?

TOPSIS can not conceptualize euclidean space assumptions, euclidean distance calculations or ranking index.

Part B

Implementing the inventory Monte Carlo simulation using Yasai and then running MCS with Manual formular input.

Pampered Pets Inventory Simulation

Mean demand	4500
Fixed order cost	$50
Unit cost	$1
Sales price	$5
Holding cost	$1
Salvage value	$3
Starting inventory	9100
Reorder point	6000
Reorder quantity	9100

Parameters of ordering policies

Policy	Reord pt	Ord quan
1	5000	8000
2	4000	8000
3	5500	100
4	6000	9100
5	800	300
6	6000	400
7	500	500

Simulation of 24-month period

Month	Beginning Inv	Demand	Units Sold	End Inv	Order Size	Order Cost	Sales rev	Holding Cost	Out of Stock?	Probabilty
1	9100	4440	4440	4660	9100	$9,150	$22,200	$4,660	0	0%
2	13760	4502	4502	9258	0	$0	$22,510	$9,258	0	
3	9258	4462	4462	4796	9100	$9,150	$22,310	$4,796	0	
4	13896	4403	4403	9493	0	$0	$22,015	$9,493	0	
5	9493	4432	4432	5061	9100	$9,150	$22,160	$5,061	0	
6	14161	4443	4443	9718	0	$0	$22,215	$9,718	0	
7	9718	4425	4425	5293	9100	$9,150	$22,125	$5,293	0	
8	14393	4601	4601	9792	0	$0	$23,005	$9,792	0	
9	9792	4622	4622	5170	9100	$9,150	$23,110	$5,170	0	
10	14270	4553	4553	9717	0	$0	$22,765	$9,717	0	
11	9717	4532	4532	5185	9100	$9,150	$22,660	$5,185	0	
12	14285	4497	4497	9788	0	$0	$22,485	$9,788	0	
13	9788	4462	4462	5326	9100	$9,150	$22,310	$5,326	0	
14	14426	4445	4445	9981	0	$0	$22,225	$9,981	0	
15	9981	4585	4585	5396	9100	$9,150	$22,925	$5,396	0	
16	14496	4582	4582	9914	0	$0	$22,910	$9,914	0	
17	9914	4474	4474	5440	9100	$9,150	$22,370	$5,440	0	
18	14540	4373	4373	10167	0	$0	$21,865	$10,167	0	
19	10167	4527	4527	5640	9100	$9,150	$22,635	$5,640	0	
20	14740	4478	4478	10262	0	$0	$22,390	$10,262	0	
21	10262	4473	4473	5789	9100	$9,150	$22,365	$5,789	0	
22	14889	4581	4581	10308	0	$0	$22,905	$10,308	0	
23	10308	4513	4513	5795	9100	$9,150	$22,565	$5,795	0	
24	14895	4515	4515	10380	0	$0	$22,575	$10,380	0	
					Totals	$109,800	$539,600	######		

Salvage value	$31,140		
		Out of stock?	
Total profit	$278,611	0	

Monte Carlo Simulation using the Yasai plug-in.

This ran 5000 simulations of 7 scenarios, each scenario using a different re-order point and order quantity. The starting inventory is set to 9100 items and had zero months of being out of stock.

Pampered Pets Inventory Simulation

Mean demand	4500
Fixed order cost	$50
Unit cost	$1
Sales price	$5
Holding cost	$1
Salvage value	$3
Starting inventory	5000
Reorder point	3500
Reorder quantity	5000

Parameters of ordering policies

Policy	Reord pt	Ord quan
1	5000	3500
2	4000	8000
3	5500	100
4	6000	9100
5	800	300
6	6000	400
7	500	500

Simulation of 24-month period

Month	Beginning Inv	Demand	Units Sold	End Inv	Order Size	Order Cost	Sales rev	Holding Cost	Out of Stock?	Probabilty
1	5000	4336	4336	664	5000	$5,050	$21,680	$664	0	8%
2	5664	4618	4618	1046	5000	$5,050	$23,090	$1,046	0	
3	6046	4610	4610	1436	5000	$5,050	$23,050	$1,436	0	
4	6436	4442	4442	1994	5000	$5,050	$22,210	$1,994	0	
5	6994	4476	4476	2518	5000	$5,050	$22,380	$2,518	0	
6	7518	4624	4624	2894	5000	$5,050	$23,120	$2,894	0	
7	7894	4518	4518	3376	5000	$5,050	$22,590	$3,376	0	
8	8376	4528	4528	3848	0	$0	$22,640	$3,848	0	
9	3848	4488	3848	0	5000	$5,050	$19,240	$0	1	
10	5000	4249	4249	751	5000	$5,050	$21,245	$751	0	
11	5751	4607	4607	1144	5000	$5,050	$23,035	$1,144	0	
12	6144	4598	4598	1546	5000	$5,050	$22,990	$1,546	0	
13	6546	4593	4593	1953	5000	$5,050	$22,965	$1,953	0	
14	6953	4435	4435	2518	5000	$5,050	$22,175	$2,518	0	
15	7518	4536	4536	2982	5000	$5,050	$22,680	$2,982	0	
16	7982	4535	4535	3447	5000	$5,050	$22,675	$3,447	0	
17	8447	4612	4612	3835	0	$0	$23,060	$3,835	0	
18	3835	4398	3835	0	5000	$5,050	$19,175	$0	1	
19	5000	4577	4577	423	5000	$5,050	$22,885	$423	0	
20	5423	4486	4486	937	5000	$5,050	$22,430	$937	0	
21	5937	4584	4584	1353	5000	$5,050	$22,920	$1,353	0	
22	6353	4523	4523	1830	5000	$5,050	$22,615	$1,830	0	
23	6830	4421	4421	2409	5000	$5,050	$22,105	$2,409	0	
24	7409	4500	4500	2909	5000	$5,050	$22,500	$2,909	0	
					Totals	$111,100	$535,455	$45,813		

Salvage value	$23,727		
		Out of stock?	
Total profit	$402,269	1	

Monte Carlo Simulation using the Yasai plug-in.

This ran 5000 simulations of 7 scenarios, each scenario using a different re-order point and order quantity. The starting inventory is set to 5000 items and had 2 months of being out of stock.

YASAI Simulation Output

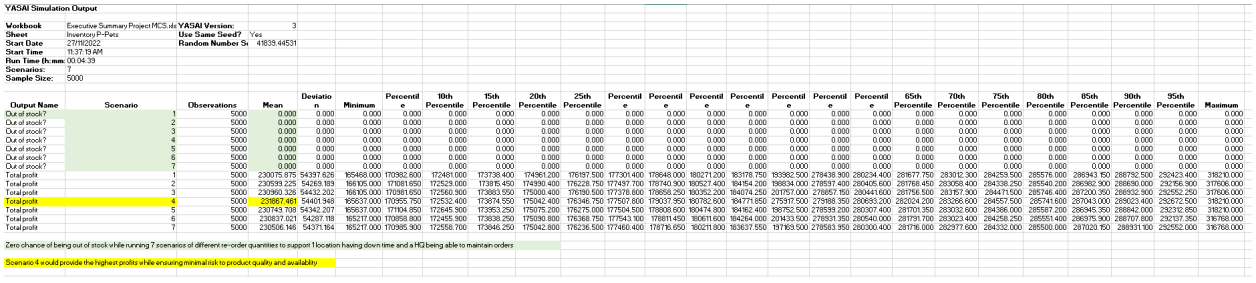
Workbook	Executive Summary Project MCS.xls	**YASAI Version:**	3
Sheet	Inventory P-Pets	**Use Same Seed?**	Yes
Start Date	27/11/2022	**Random Number Se**	41839.44531
Start Time	11:37:19 AM		
Run Time (h:mm:	00:04:39		
Scenarios:	7		
Sample Size:	5000		

Output Name	Scenario	Observations	Mean	Deviation	Minimum	P
Out of stock?	1	5000	0.000	0.000	0.000	
Out of stock?	2	5000	0.000	0.000	0.000	
Out of stock?	3	5000	0.000	0.000	0.000	
Out of stock?	4	5000	0.000	0.000	0.000	
Out of stock?	5	5000	0.000	0.000	0.000	
Out of stock?	6	5000	0.000	0.000	0.000	
Out of stock?	7	5000	0.000	0.000	0.000	
Total profit	1	5000	230075.875	54397.626	165468.000	17
Total profit	2	5000	230599.225	54269.189	166105.000	1
Total profit	3	5000	230960.326	54432.202	166105.000	1
Total profit	4	5000	231867.461	54401.948	165637.000	17
Total profit	5	5000	230749.708	54342.207	165637.000	1
Total profit	6	5000	230837.021	54287.118	165217.000	17
Total profit	7	5000	230506.146	54371.164	165217.000	17

Zero chance of being out of stock while running 7 scenarios of different re-order quantities to support 1 location having down tim

Scenario 4 would provide the highest profits while ensuring minimal risk to product quality and availablity

This simulation output indicated that the store could operate with scenario 4 inventory configuration and starting quantity to achieve the highest profit with zero chance of running out of stock.



A full screen capture of the image above.

YASAI Simulation Output

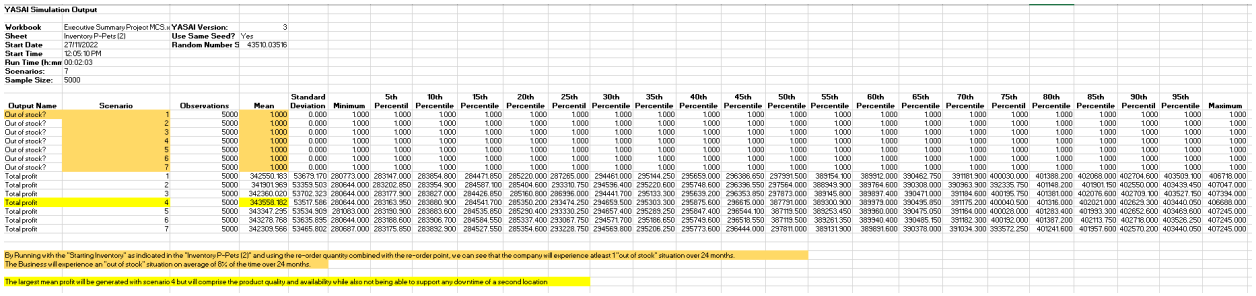
Workbook	Executive Summary Project MCS.xlsx	**YASAI Version:**	3
Sheet	Inventory P-Pets (2)	**Use Same Seed?**	Yes
Start Date	27/11/2022	**Random Number Seed:**	43510.03516
Start Time	12:05:10 PM		
Run Time (h:mm:ss)	00:02:03		
Scenarios:	7		
Sample Size:	5000		

Output Name	Scenario	Observations	Mean	Standard Deviation	Minimum	5th Percentile	10th Percentile	15th Percentile	20th Percentile	25th Percentile	30th Percentile	35th Percentile	40th Percentile	45th Percentile	50th Percentile
Out of stock?	1	5000	1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Out of stock?	2	5000	1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Out of stock?	3	5000	1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Out of stock?	4	5000	1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Out of stock?	5	5000	1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Out of stock?	6	5000	1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Out of stock?	7	5000	1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Total profit	1	5000	342550.183	53679.170	280773.000	283147.000	283854.800	284471.850	285220.000	287265.000	294461.000	295144.250	295659.000	296386.650	297991.500
Total profit	2	5000	341901.969	53359.503	280644.000	283202.850	283954.900	284587.100	285404.600	293310.750	294536.400	295220.600	295748.600	296396.550	297564.000
Total profit	3	5000	342360.020	53702.323	280644.000	283177.900	283827.000	284426.850	285160.800	286996.000	294441.700	295133.300	295639.200	296353.850	297873.000
Total profit	4	5000	343558.182	53517.586	280644.000	283163.950	283880.900	284541.700	285350.200	293474.250	294659.500	295303.300	295875.600	296615.000	387791.000
Total profit	5	5000	343347.295	53534.909	281083.000	283190.900	283883.600	284535.850	285290.400	293330.250	294657.400	295289.250	295847.400	296544.100	387119.500
Total profit	6	5000	343278.768	53635.895	280644.000	283188.600	283906.700	284584.550	285337.400	293067.750	294571.700	295186.650	295749.600	296518.550	387119.500
Total profit	7	5000	342309.566	53465.802	280687.000	283175.850	283892.900	284527.550	285354.600	293228.750	294569.800	295206.250	295773.600	296444.000	297811.000

By Running with the "Starting Inventory" as indicated in the "Inventory P-Pets (2)" and using the re-order quantity combined with the re-order point, we can see that the company will experience atleast 1 "out of stock" situation over 24 months.
The Business will experience an "out of stock" situation on average of 8% of the time over 24 months.

The largest mean profit will be generated with scenario 4 but will comprise the product quality and availability while also not being able to support any downtime of a second location

This simulation output indicated that the store could operate with scenario 4 inventory configuration and starting quantity to achieve the highest profit with certainty of running out of stock at least once over the next 24 months.



A full screen capture of the image above.