Assignment 4

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Question 1:

Chapter 9, question 6: Summarize the important knowledge that you need to successfully build good decision models.

In order to build a successful decision model, we need to know our inputs and their types. we have 3 types of inputs Data(which assumed to be constant), Uncontrollable variables(which are quantities that can change but cannot be directly controlled by the decision maker), and Decision variables (which are controllable and can be selected at the discretion of the decision maker). Moreover, we need to know the Derived Variable or output. And then we can make a decision model based on what needs to determine.

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Chapter 9, question 7: Explain basic spreadsheet engineering approaches for implementing decision models in Excel.

there are three basic approaches:

1. Improve the design and format of the spreadsheet itself: after the inputs, outputs, and key relationships are well understood, you should sketch a logical design of the spreadsheet. It is good practice to separate the model inputs from the model itself and to reference the input cells in the model formulas; that way, any changes in the inputs will be automatically reflected in the model. Another useful approach is to break complex formulas into smaller pieces. This reduces typographical errors, makes it easier to check your results, and also makes the spreadsheet easier to read for the user.
2. Improve the process used to develop a spreadsheet: If you sketched out a conceptual design of the spreadsheet, work on each part individually before moving on to the others to ensure that it is correct. And every time check the formula with input with known results.
3. Inspect your results carefully and use appropriate tools available in Excel: The *Data Validation* tool can signal errors if an input value is not the right type. With this tool, you may define validation criteria for model inputs and pop up an error message if the wrong values or type of data are entered. The Excel *Auditing* tool also helps you

to validate the logic of formulas by visually showing the relationships between input data and cell formulas.

Chapter 10, question 1: Explain the concept of risk analysis and how Monte Carlo simulation can provide useful information for making decisions.

risk analysis seeks to examine the impacts of uncertainty in the estimates and their potential interaction with one another on the output variable of interest. the challenge to risk analysts is to frame the output of risk analysis procedures in a manner that makes sense to the manager and provides clear insight into the problem, suggesting that simulation has many advantages. Monte Carlo simulation is the process of generating random values for uncertain inputs in a model, computing the output variables of interest, and repeating this process for many trials in order to understand the distribution of the output results.

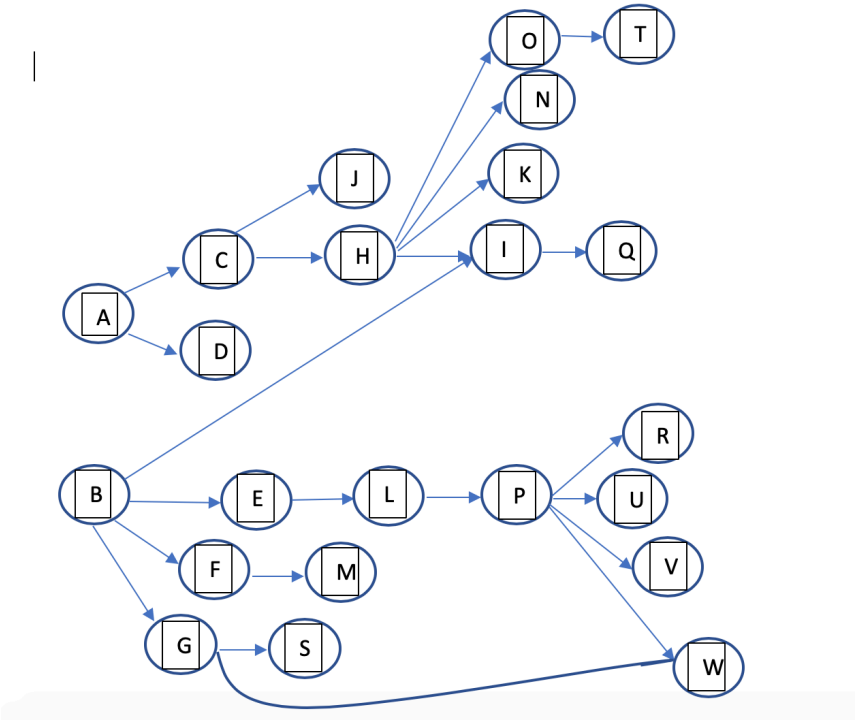
Chapter 10, question: Is Risk from PDF or CDF? What question do you ask CDF to estimate risk?

Most of the time managers are looking for certainty level. A certainty level is a probability interval that states the probability of the forecast falling within the specified range of the grabbers. So, the risk is from CDF because you need to calculate the probability of the range and you need to use these capabilities to answer the risk analysis questions. the questions can be like: What is the risk over the five years? What are the chances something happens in the third year? and so on.

Question 2:

Part 1, Chapter 9, problem 18: Jennifer Bellin has been put in charge of planning her company's annual leadership conference. The dates of the conference have been determined by her company's executive team. The table below contains information about the activities, predecessors, and activity times (in days). Develop a spreadsheet model for finding the project completion time and critical path.

In order to answer this question is better to first draw a path and then calculate the early start and early finish for each activities base on predecessors.
For this question, you can see the path in picture one.



Picture 1: Critical path

Now, base on the path we can calculate the time each activity start and finish, and then reach to the total time that project needs. We should do that step by step. Each time, we start with action A and B, and add the time it takes to finish them, then use that as a start point for the next one. You can see the result of these steps in picture 2.

A	B	C	D	E	F
	Activity	redecessor	ctivity Tim	Early start	Early Finish
A	Develop conference theme		3	0	=E2+D2
B	Determine attendees 3		3	0	=E3+D3
C	Contract facility	A	7	=F2	=E4+D4
D	Choose entertainment	A	10	=F2	=D5+E5
E	Send announcement	B	5	=F3	=E6+D6
F	Order gifts	B	5	=F3	=E7+D7
G	Order materials	B	1	=F3	=E8+D8
H	Plan schedule of sessions	C	40	=F4	=E9+D9
I	Design printed materials	B,H	15	=F9	=E10+D10
J	Schedule session rooms	C	1	=F4	=E11+D11
K	Print directions	H	10	=F9	=E12+D12
L	Develop travel memo	E	5	=F6	=E13+D13
M	Write gift letter	F	5	=F7	=E14+D14
N	Confirm catering	H	3	=F9	=E15+D15
O	Communicate with speakers	H	3	=F9	=E16+D16
P	Track RSVPs and assign roommates	L	30	=F13	=E17+D17
Q	Print materials	I	3	=F10	=E18+D18
R	Assign table numbers	P	1	=F17	=E19+D19
S	Compile packets of materials	G	3	=F8	=E20+D20
T	Submit audio-visual needs	O	1	=F16	=E21+D21
U	Put together welcome letter	P	5	=F17	=E22+D22
V	Confirm arrangements with hotel	P	3	=F17	=E23+D23
W	Print badges	G,P	5	=F17	=E24+D24

	Activity	Predecessors	Activity Time	Early start	Early Finish			
A	Develop conference theme		3	0	3		Project Finish Time	68
B	Determine attendees 3		3	0	3			
C	Contract facility	A	7	3	10			
D	Choose entertainment	A	10	3	13			
E	Send announcement	B	5	3	8			
F	Order gifts	B	5	3	8			
G	Order materials	B	1	3	4			
H	Plan schedule of sessions	C	40	10	50			
I	Design printed materials	B,H	15	50	65			
J	Schedule session rooms	C	1	10	11			
K	Print directions	H	10	50	60			
L	Develop travel memo	E	5	8	13			
M	Write gift letter	F	5	8	13			
N	Confirm catering	H	3	50	53			
O	Communicate with speakers	H	3	50	53			
P	Track RSVPs and assign roommates	L	30	13	43			
Q	Print materials	I	3	65	68			
R	Assign table numbers	P	1	43	44			
S	Compile packets of materials	G	3	4	7			
T	Submit audio-visual needs	O	1	53	54			
U	Put together welcome letter	P	5	43	48			
V	Confirm arrangements with hotel	P	3	43	46			
W	Print badges	G,P	5	43	48			

Picture 2: spreadsheet model for project

As you can see in picture 2, the longest early finish time is 68, so the earliest the project completion time is going to be 68.

Part 2: Solve the problem again to calculate the critical path assuming task W takes 7 units of time to complete.

In order to answer this part, I just change the activity time of W to 7. You can see the result in picture 3.

	Activity	Predecessors	Activity Time	Early start	Early Finish			
A	Develop conference theme		3	0	3		Project Finish Time	68
B	Determine attendees 3		3	0	3			
C	Contract facility	A	7	3	10			
D	Choose entertainment	A	10	3	13			
E	Send announcement	B	5	3	8			
F	Order gifts	B	5	3	8			
G	Order materials	B	1	3	4			
H	Plan schedule of sessions	C	40	10	50			
I	Design printed materials	B,H	15	50	65			
J	Schedule session rooms	C	1	10	11			
K	Print directions	H	10	50	60			
L	Develop travel memo	E	5	8	13			
M	Write gift letter	F	5	8	13			
N	Confirm catering	H	3	50	53			
O	Communicate with speakers	H	3	50	53			
P	Track RSVPs and assign roommates	L	30	13	43			
Q	Print materials	I	3	65	68			
R	Assign table numbers	P	1	43	44			
S	Compile packets of materials	G	3	4	7			
T	Submit audio-visual needs	O	1	53	54			
U	Put together welcome letter	P	5	43	48			
V	Confirm arrangements with hotel	P	3	43	46			
W	Print badges	G,P	7	43	50			

Picture 3: new spreadsheet model for project

As you can see in picture 3, the early finish time for W change from 48 to 50, but since the last task that needs to finish in order to finish the project is task Q, so the project finish time does not change.

Question 3, part1, Chapter 9, problem 15: Koehler Vision Associates (KVA) specializes in laser-assisted corrective eye surgery. Prospective patients make appointments for prescreening exams to determine their candidacy for the surgery, and if they qualify, the $300 charge is applied as a deposit for the actual procedure. The weekly demand is 175, and about 15% of prospective patients fail to show up or cancel their exam at the last minute. Patients that do not show up do not pay the prescreening fee. KVA can handle 125 patients per week and is considering overbooking its appointments to reduce the lost revenue associated with cancellations. However, any patient who is overbooked may spread unfavorable comments about the company; thus, the overbooking cost is estimated to be $125, the value of a referral. Develop a spreadsheet model for

calculating net revenue, and use data tables to study how revenue is affected by changes in the number of appointments accepted and patient demand.

so I summarized the question in below:

cost each unit: 300 $,weekly demand: 175, cancellation rate: 15%, Capital: 125 per week, overbooking cost: 125 $

Based on the question, since the weekly demand is more than capital, every time they have full capacity, so the difference in revenue caused by the number of overbooking patient. The cancellation rate can be from 0 to 15 percent, and I assumed every day they book all the demand. In order to study the impact of changes in the number of appointments, I generate the 20 samples with a different number of overbooking and calculate the revenue. You can see the result in picture 4.

D	E	F	G	H
number of cancellation	number of cancellation(fix)	number of overbooking	overbooking cost	profit
=RANDBETWEEN(1,(125*0.15))	7	=175-125-E2	=F2*B3	=(B2*125)-G2
=RANDBETWEEN(1,(125*0.15))	10	=175-125-E3	=F3*B3	=(B2*125)-G3
=RANDBETWEEN(1,(125*0.15))	7	=175-125-E4	=F4*B3	=(B2*125)-G4
=RANDBETWEEN(1,(125*0.15))	16	=175-125-E5	=F5*B3	=(B2*125)-G5
=RANDBETWEEN(1,(125*0.15))	4	=175-125-E6	=F6*B3	=(B2*125)-G6
=RANDBETWEEN(1,(125*0.15))	2	=175-125-E7	=F7*B3	=(B2*125)-G7
=RANDBETWEEN(1,(125*0.15))	8	=175-125-E8	=F8*B3	=(B2*125)-G8
=RANDBETWEEN(1,(125*0.15))	13	=175-125-E9	=F9*B3	=(B2*125)-G9
=RANDBETWEEN(1,(125*0.15))	15	=175-125-E10	=F10*B3	=(B2*125)-G10
=RANDBETWEEN(1,(125*0.15))	5	=175-125-E11	=F11*B3	=(B2*125)-G11
=RANDBETWEEN(1,(125*0.15))	6	=175-125-E12	=F12*B3	=(B2*125)-G12
=RANDBETWEEN(1,(125*0.15))	1	=175-125-E13	=F13*B3	=(B2*125)-G13
=RANDBETWEEN(1,(125*0.15))	10	=175-125-E14	=F14*B3	=(B2*125)-G14
=RANDBETWEEN(1,(125*0.15))	18	=175-125-E15	=F15*B3	=(B2*125)-G15
=RANDBETWEEN(1,(125*0.15))	3	=175-125-E16	=F16*B3	=(B2*125)-G16
=RANDBETWEEN(1,(125*0.15))	2	=175-125-E17	=F17*B3	=(B2*125)-G17
=RANDBETWEEN(1,(125*0.15))	8	=175-125-E18	=F18*B3	=(B2*125)-G18
=RANDBETWEEN(1,(125*0.15))	9	=175-125-E19	=F19*B3	=(B2*125)-G19
=RANDBETWEEN(1,(125*0.15))	18	=175-125-E20	=F20*B3	=(B2*125)-G20
=RANDBETWEEN(1,(125*0.15))	16	=175-125-E21	=F21*B3	=(B2*125)-G21

D	E	F	G	H
number of cancellation	number of cancellation(fix)	number of overbooking	overbooking cost	profit
4	7	43	5375	32125
18	10	40	5000	32500
5	7	43	5375	32125
6	16	34	4250	33250
7	4	46	5750	31750
16	2	48	6000	31500
13	8	42	5250	32250
17	13	37	4625	32875
8	15	35	4375	33125
11	5	45	5625	31875
13	6	44	5500	32000
4	1	49	6125	31375
14	10	40	5000	32500
3	18	32	4000	33500
9	3	47	5875	31625
16	2	48	6000	31500
4	8	42	5250	32250
10	9	41	5125	32375
8	18	32	4000	33500
6	16	34	4250	33250

Picture 4: a model for calculating net revenue

part 2: solve the problem again if KVA can handle 138 patients per week

Now, I change the model for 138, you can see the result in picture 5.

D	E	F	G	H
number of cancellation	number of cancellation(fix)	number of overbooking	overbooking cost	profit
=RANDBETWEEN(1,(138*0.15))	15	=175-138-E2	=F2*B3	=(B2*125)-G2
=RANDBETWEEN(1,(138*0.15))	1	=175-138-E3	=F3*B3	=(B2*125)-G3
=RANDBETWEEN(1,(138*0.15))	4	=175-138-E4	=F4*B3	=(B2*125)-G4
=RANDBETWEEN(1,(138*0.15))	19	=175-138-E5	=F5*B3	=(B2*125)-G5
=RANDBETWEEN(1,(138*0.15))	19	=175-138-E6	=F6*B3	=(B2*125)-G6
=RANDBETWEEN(1,(138*0.15))	14	=175-138-E7	=F7*B3	=(B2*125)-G7
=RANDBETWEEN(1,(138*0.15))	9	=175-138-E8	=F8*B3	=(B2*125)-G8
=RANDBETWEEN(1,(138*0.15))	17	=175-138-E9	=F9*B3	=(B2*125)-G9
=RANDBETWEEN(1,(138*0.15))	1	=175-138-E10	=F10*B3	=(B2*125)-G10
=RANDBETWEEN(1,(138*0.15))	13	=175-138-E11	=F11*B3	=(B2*125)-G11
=RANDBETWEEN(1,(138*0.15))	10	=175-138-E12	=F12*B3	=(B2*125)-G12
=RANDBETWEEN(1,(138*0.15))	1	=175-138-E13	=F13*B3	=(B2*125)-G13
=RANDBETWEEN(1,(138*0.15))	3	=175-138-E14	=F14*B3	=(B2*125)-G14
=RANDBETWEEN(1,(138*0.15))	10	=175-138-E15	=F15*B3	=(B2*125)-G15
=RANDBETWEEN(1,(138*0.15))	12	=175-138-E16	=F16*B3	=(B2*125)-G16
=RANDBETWEEN(1,(138*0.15))	13	=175-138-E17	=F17*B3	=(B2*125)-G17
=RANDBETWEEN(1,(138*0.15))	20	=175-138-E18	=F18*B3	=(B2*125)-G18
=RANDBETWEEN(1,(138*0.15))	4	=175-138-E19	=F19*B3	=(B2*125)-G19
=RANDBETWEEN(1,(138*0.15))	16	=175-138-E20	=F20*B3	=(B2*125)-G20
=RANDBETWEEN(1,(138*0.15))	17	=175-138-E21	=F21*B3	=(B2*125)-G21

D	E	F	G	H
number of cancellation	number of cancellation(fix)	number of overbooking	overbooking cost	profit
8	15	22	2750	34750
20	1	36	4500	33000
17	4	33	4125	33375
6	19	18	2250	35250
4	19	18	2250	35250
6	14	23	2875	34625
12	9	28	3500	34000
6	17	20	2500	35000
18	1	36	4500	33000
1	13	24	3000	34500
15	10	27	3375	34125
20	1	36	4500	33000
2	3	34	4250	33250
2	10	27	3375	34125
19	12	25	3125	34375
4	13	24	3000	34500
15	20	17	2125	35375
2	4	33	4125	33375
1	16	21	2625	34875
11	17	20	2500	35000

Picture 5: a model for calculating net revenue

Question 4: Setup an outsourcing decision model (see slides for model setup and procedure), for the input parameters:

- **Cost to manufacture is normally distributed between 90 and 160 with SDT of 11.**
- **Cost to outsource is normally distributed with mean 172 and STD of 13.**
- **Capital is one of {47300,48440,50010,51600,52500}**
- **Demand is uniformly distributed between 830 to 999**

Since the cost of manufacture is normally distributed and it is between 90 an 160, the mean is 125.

I am going to calculate everything for 20 trails. You can see the result is Picture 6.

	A	B	C	D	E	F	G	H	I	J
1		Input	Input	Input	input	output	output	output	output	output
2		Cost to manufact	st to outsour	Capital	Demand	nufacture	sourcing c	Decision	Decision (0,1)	Cost difference
3	Trail	125	172	50010	915	164385	157380	outsource	1	-7005
4	1	86.67734226	180.9238196	47300	943	129037	170611	Manufacture	0	41574.42818
5	2	124.8641296	184.4628836	48440	835	152702	154027	Manufacture	0	1324.959652
6	3	139.9412207	173.3471894	50010	874	172319	151505	outsource	1	-20813.18335
7	4	126.7365919	152.762643	51600	996	177830	152152	outsource	1	-25678.05313
8	5	136.6233347	172.5008729	52500	998	188850	172156	outsource	1	-16694.2169
9	6	143.3546347	192.6166264	47300	988	188934	190305	Manufacture	0	1370.847855
10	7	119.9997649	164.6871884	48440	969	164720	159582	outsource	1	-5137.886682
11	8	132.4859982	184.8926192	50010	858	163683	158638	outsource	1	-5045.119129
12	9	120.7546495	197.5336322	51600	859	155328	169681	Manufacture	0	14353.14611
13	10	127.9004453	149.6868923	52500	886	165820	132623	outsource	1	-33197.20796
14	11	114.8691807	175.3762676	47300	959	157460	168186	Manufacture	0	10726.29634
15	12	143.9193619	169.896122	48440	866	173074	147130	outsource	1	-25944.12577
16	13	106.9044759	150.3640122	50010	919	148255	138185	outsource	1	-10070.68608
17	14	129.2795206	155.8257392	51600	986	179070	153644	outsource	1	-25425.42846
18	15	106.0108715	159.3258697	52500	843	141867	134312	outsource	1	-7555.456494
19	16	129.5567947	161.0261009	47300	936	168565	150720	outsource	1	-17844.72938
20	17	127.612034	193.5498102	48440	963	171330	186388	Manufacture	0	15058.07855
21	18	123.2226127	183.4005975	50010	969	169413	177715	Manufacture	0	8302.46723
22	19	102.8152435	175.5670147	51600	934	147629	163980	Manufacture	0	16350.15428
23	20	127.317269	180.7893467	52500	917	169250	165784	outsource	1	-3466.104788
24									12	

	A	B	C	D	E	F	G	H	I	J
1		Input	Input	Input	input	output	output	output	output	output
2		Cost to manufacture	Cost to outsource	Capital	Demand	Manufacture cost	outsourcing cost	Decision	Decision (0,1)	Cost difference
3	Trail	125	172	50010	915	=E3*B3+D3	=C3*E3	=IF(F3<G3,"Manufacture","outsource")	=IF(H3="outsource",1,0)	=G3-F3
4	1	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	47300	=RANDBETWEEN(830,999)	=E4*B4+D4	=C4*E4	=IF(F4<G4,"Manufacture","outsource")	=IF(H4="outsource",1,0)	=G4-F4
5	2	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	48440	=RANDBETWEEN(830,999)	=E5*B5+D5	=C5*E5	=IF(F5<G5,"Manufacture","outsource")	=IF(H5="outsource",1,0)	=G5-F5
6	3	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	50010	=RANDBETWEEN(830,999)	=E6*B6+D6	=C6*E6	=IF(F6<G6,"Manufacture","outsource")	=IF(H6="outsource",1,0)	=G6-F6
7	4	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	51600	=RANDBETWEEN(830,999)	=E7*B7+D7	=C7*E7	=IF(F7<G7,"Manufacture","outsource")	=IF(H7="outsource",1,0)	=G7-F7
8	5	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	52500	=RANDBETWEEN(830,999)	=E8*B8+D8	=C8*E8	=IF(F8<G8,"Manufacture","outsource")	=IF(H8="outsource",1,0)	=G8-F8
9	6	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	47300	=RANDBETWEEN(830,999)	=E9*B9+D9	=C9*E9	=IF(F9<G9,"Manufacture","outsource")	=IF(H9="outsource",1,0)	=G9-F9
10	7	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	48440	=RANDBETWEEN(830,999)	=E10*B10+D10	=C10*E10	=IF(F10<G10,"Manufacture","outsource")	=IF(H10="outsource",1,0)	=G10-F10
11	8	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	50010	=RANDBETWEEN(830,999)	=E11*B11+D11	=C11*E11	=IF(F11<G11,"Manufacture","outsource")	=IF(H11="outsource",1,0)	=G11-F11
12	9	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	51600	=RANDBETWEEN(830,999)	=E12*B12+D12	=C12*E12	=IF(F12<G12,"Manufacture","outsource")	=IF(H12="outsource",1,0)	=G12-F12
13	10	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	52500	=RANDBETWEEN(830,999)	=E13*B13+D13	=C13*E13	=IF(F13<G13,"Manufacture","outsource")	=IF(H13="outsource",1,0)	=G13-F13
14	11	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	47300	=RANDBETWEEN(830,999)	=E14*B14+D14	=C14*E14	=IF(F14<G14,"Manufacture","outsource")	=IF(H14="outsource",1,0)	=G14-F14
15	12	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	48440	=RANDBETWEEN(830,999)	=E15*B15+D15	=C15*E15	=IF(F15<G15,"Manufacture","outsource")	=IF(H15="outsource",1,0)	=G15-F15
16	13	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	50010	=RANDBETWEEN(830,999)	=E16*B16+D16	=C16*E16	=IF(F16<G16,"Manufacture","outsource")	=IF(H16="outsource",1,0)	=G16-F16
17	14	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	51600	=RANDBETWEEN(830,999)	=E17*B17+D17	=C17*E17	=IF(F17<G17,"Manufacture","outsource")	=IF(H17="outsource",1,0)	=G17-F17
18	15	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	52500	=RANDBETWEEN(830,999)	=E18*B18+D18	=C18*E18	=IF(F18<G18,"Manufacture","outsource")	=IF(H18="outsource",1,0)	=G18-F18
19	16	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	47300	=RANDBETWEEN(830,999)	=E19*B19+D19	=C19*E19	=IF(F19<G19,"Manufacture","outsource")	=IF(H19="outsource",1,0)	=G19-F19
20	17	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	48440	=RANDBETWEEN(830,999)	=E20*B20+D20	=C20*E20	=IF(F20<G20,"Manufacture","outsource")	=IF(H20="outsource",1,0)	=G20-F20
21	18	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	50010	=RANDBETWEEN(830,999)	=E21*B21+D21	=C21*E21	=IF(F21<G21,"Manufacture","outsource")	=IF(H21="outsource",1,0)	=G21-F21
22	19	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	51600	=RANDBETWEEN(830,999)	=E22*B22+D22	=C22*E22	=IF(F22<G22,"Manufacture","outsource")	=IF(H22="outsource",1,0)	=G22-F22
23	20	=NORMINV(RAND(),125,11)	=NORMINV(RAND(),172,13)	52500	=RANDBETWEEN(830,999)	=E23*B23+D23	=C23*E23	=IF(F23<G23,"Manufacture","outsource")	=IF(H23="outsource",1,0)	=G23-F23
24									=SUM(I4:I23)	

Picture 6: simulation for manufacture and outsource

Based on picture 6, most of the time the result is outsourcing (12 times out of 20), so in here outsourcing is a better option than manufacturing the product.

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Question 5: For the model set up in problem 4,

5.1. Determine the probability of decision variable = Outsourcing. Hint: see slides 35 to 37.

5.2. What is the probability that manufacturing cost is less than 90% of its maximum value in your model?

5.3. What is the probability that outsourcing cost is less than 85% of its maximum value in its model?

5.4. Add 95% confidence limits on the probability of decision variable = Outsourcing from 4.1

5.1 in question 4, 16 times out of 20 the answer was outsourcing, so the probability is 12/20= 60%

5.2, 5.3 In order to answer these two question, I find out how many times this condition happen, you can see the result in picture 7

V	W	X	Y
		Manufacturing less than 90%max	Manufacturing less than 85%max
90% max of Manufacture cost	=MAX(Q4:Q23)*0.9		
85% max of outourcing cost	=0.85*MAX(R4:R23)	=IF(Q4<W3,1,0)	=IF(R4<W4,1,0)
		=IF(Q5<W4,1,0)	=IF(R5<W5,1,0)
		=IF(Q6<W5,1,0)	=IF(R6<W6,1,0)
		=IF(Q7<W6,1,0)	=IF(R7<W7,1,0)
		=IF(Q8<W7,1,0)	=IF(R8<W8,1,0)
		=IF(Q9<W8,1,0)	=IF(R9<W9,1,0)
		=IF(Q10<W9,1,0)	=IF(R10<W10,1,0)
		=IF(Q11<W10,1,0)	=IF(R11<W11,1,0)
		=IF(Q12<W11,1,0)	=IF(R12<W12,1,0)
		=IF(Q13<W12,1,0)	=IF(R13<W13,1,0)
		=IF(Q14<W13,1,0)	=IF(R14<W14,1,0)
		=IF(Q15<W14,1,0)	=IF(R15<W15,1,0)
		=IF(Q16<W15,1,0)	=IF(R16<W16,1,0)
		=IF(Q17<W16,1,0)	=IF(R17<W17,1,0)
		=IF(Q18<W17,1,0)	=IF(R18<W18,1,0)
		=IF(Q19<W18,1,0)	=IF(R19<W19,1,0)
		=IF(Q20<W19,1,0)	=IF(R20<W20,1,0)
		=IF(Q21<W20,1,0)	=IF(R21<W21,1,0)
		=IF(Q22<W21,1,0)	=IF(R22<W22,1,0)
		=IF(Q23<W22,1,0)	=IF(R23<W23,1,0)
		=IF(Q24<W23,1,0)	=IF(R24<W24,1,0)
		=SUM(X4:X24)	=SUM(Y4:Y24)

		Manufacturing less than 90%max	Manufacturing less than 85%max
90% max of Manufacture cost	170040.9411		
85% max of outourcing cost	161759.4429	1	0
		1	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		0	0
		2	0

Picture 7

Based on picture 7, the number of manufacturing cost is less than 90% of its maximum is 2 out of 20, so p=2/20=10%. And the number of outsourcing cost is less than 85% of its maximum is 0, so p=0/20=0%.

5.4 For answering this question I used confidence. norm function, alpha=0.05, STD= 13, size= 20, I should round the result to up so the result is equal to 6, so the range for outsourcing is [166,178]