Cover Page

Business Name: QBUS3330

Project Name: Assignment 1

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1. Evaluation of mandatory drug testing for athletes

1.1Based on the data, on payoffs and the reliability of tests it is advised that AIS consider whether to implement MDT for athletes.

This table assigns values to show the comparative advantages and disadvantages of different results, where the monetary values are compared to the expense of one drug test(C1), set to -1)

	INDEX					
	user test positive	**user test negative**	**non-user test positive**	**non-user test negative**	**no test on user**	**no test on non-user**
ban	(+B,- C1)	(+B,- C1)	(-C1, -C2,- C3)	(-C1,- C2,- C3)	(+B)	(-C3)
not ban	(-C1,- C4)	(-C1,- C4)	(-C1, -C2)	(-C1,- C2)	(-C4)	0

The numerical payoff table translates the indexed notation into specific numerical values, assuming C1 represents a standard cost unit.

	NUMERICAL					
	user test positive	**user test negative**	**non-user test positive**	**non-user test negative**	**no test on user**	**no test on non-user**
ban	(-1+25=24)	(-1+25=24)	(-1-2-20=-23)	(-1-2-20)	(+25=25)	(-20=-20)
not ban	(-1-10=-11))	(-1-10=-11)	(-1-2=-3)	(-1-2=-3)	(-10=-10)	0=0

1.2 Relevant posterior probabilities

Bayesian Calculations

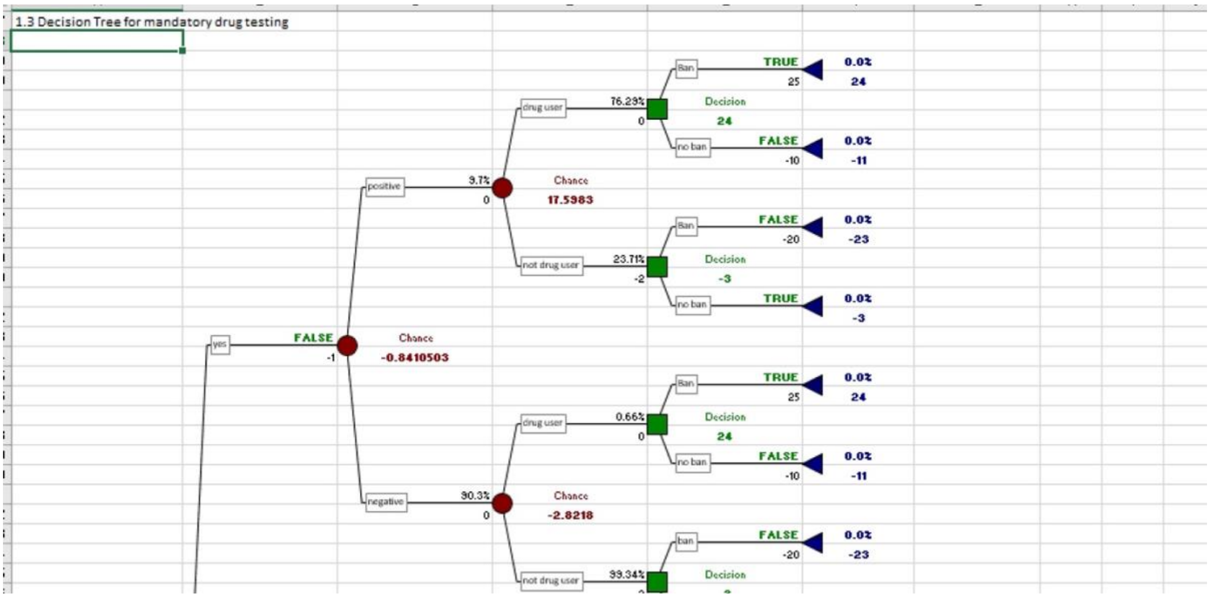
- **For a Positive Test Outcome:**
  - Prior probability of an athlete being a drug user (P(D)) was set at 8%.
  - Prior probability of an athlete being a non-user (P(D-)) was set at 92%.
  - Likelihood of a positive test given the athlete is a drug user (P(T+ | D)) was 92.5%.
  - Likelihood of a positive test given the athlete is a non-user (P(T+ | D-)) was 2.5%.
- **For a Negative Test Outcome:**
  - Likelihood of a negative test given the athlete is a drug user (P(T- | D)) was 7.5%.
  - Likelihood of a negative test given the athlete is a non-user (P(T- | D-)) was 97.5%.

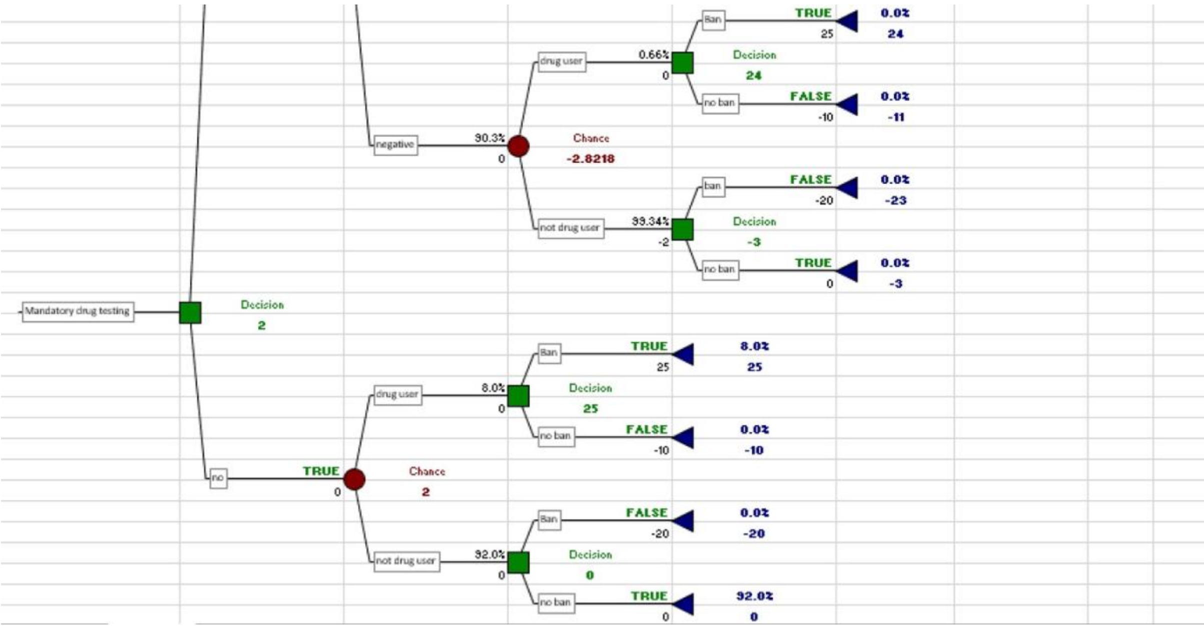
	Bayes table for positive test			
State	Prior	Likelihood	Product	Posterior
Drug user	0.08	0.925	0.074	76.29%
Non-drug user	0.92	0.025	0.023	23.71%
			0.097	
	Bayes table for negative test			
State	Prior	Likelihood	Product	Posterior
Drug user	0.08	0.075	0.006	0.66%
Non-drug user	0.92	0.975	0.897	99.34%
			0.903	

The posterior probabilities calculated from these data points provided the following insights:

- **Positive Test Analysis**:
  - There is a 76.29% probability that an athlete is a drug user if they test positive.
  - There is a 23.71% probability that a non-user has incorrectly tested positive, highlighting a potential issue with false positives.
- **Negative Test Analysis**:
  - There is a 0.66% probability that an athlete is a drug user if they test negative, suggesting high test sensitivity.
  - There is a 99.34% probability that an athlete is not a drug user if they test negative, indicating strong test specificity.

1.3 Decision Tree





Conclusion

Based on the calculated evps, the decision tree advises against the implementation of mandatory drug testing.

1.4 Evaluating the best strategy

This section outlines the best strategy moving forward.

Best Strategy

The decision tree indicates that it's best for AIS not to conduct drug testing due, to the costs involved and privacy issues while considering the minimal advantages considering the low prevalence of drug use.

Net benefit:

Net Benefit=−0.08×(−10)=0.8 (in units of the cost of a test, indicating a saving or a reduced loss)

Discussion

Opting against MDT saves costs, preserves ethical standing, and avoids complexities of large-scale testing, given low drug use prevalence.

1.5 Brief Sensitivity analysis

Prevalence of Drug Use (P(D)):

- **Assumption:** 8% prevalence.

- **Impact:** When the probability of detection is higher (P(D)) it makes sense to conduct tests that yield detection rates and advantages for users in comparison to situations where P(D) is lower since this reduces the justification, for costs by identifying fewer users.

Cost of Testing (C1):

- **Assumption:** Indexed at -1.
- **Impact:** Higher costs deter testing by increasing expenses; lower costs encourage testing by reducing financial barriers.

Cost of Violating Privacy (C2):

- **Assumption:** High, indexed at -2.
- **Impact:** Citing risks heightened concerns discourage C2 from advocating testing but if privacy issues improve softened stance may favor testing.

Cost of Falsely Accusing Someone (C3):

- **Assumption:** High, indexed at -20.
- **Impact:** Lower C3 favors testing; higher C3 deters due to severe impacts.

Benefit of Identifying a Drug User (B):

- **Assumption:** Significant, set at +25.
- **Impact:** Higher B strengthens testing; lower B reduces incentives if costs and risks are high.

2.1

a)

Logical bids for IC would be:

Bid 1: $299,000 which is just below $230,000, strategically undercuts competitors' starting bids, maximizing chances to win when they bid slightly higher.

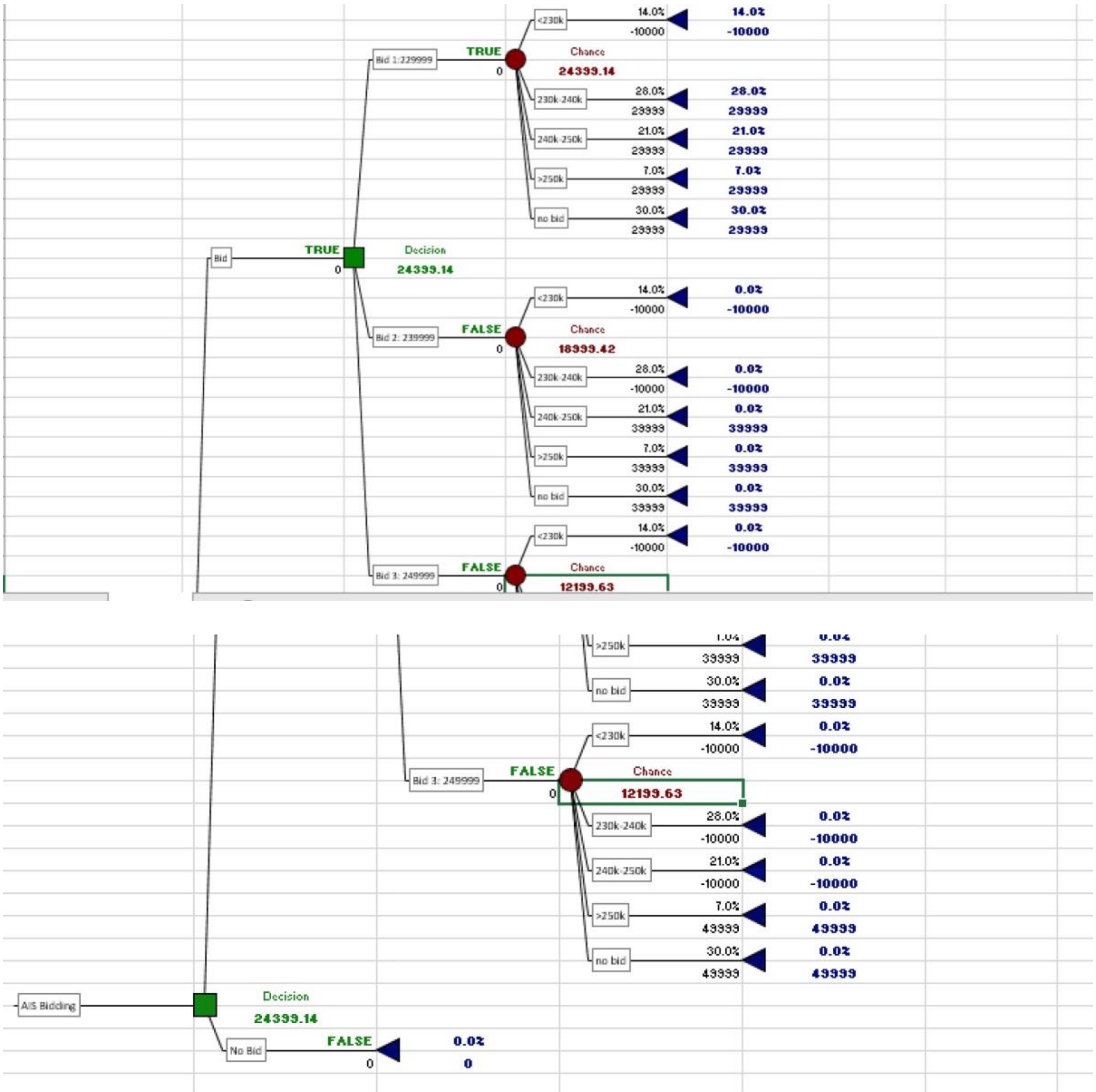
Bid 2: $239,999, stays competitive within the $230,000-$240,000 range, covering scenarios closer to $240,000 while undercutting higher bids.

Bid 3: $249,999, competes in the higher range, potentially outbidding the $240,000-$250,000 range, targeting profit when higher bids are unlikely.

			STATE			
Action	State 1(No rival bid)	State 2(<$230k)	State 3(230k-240k)	state 4(240k-250k)	State 5(>250k)	EMV
Bid 1: $229,999	$29,999	-$10,000	$29,999	$29,999	$29,999	$24,399.14
Bid 2: $239,999	$39,999	-$10,000	-$10,000	$39,999	$39,999	$18,999.42
Bid 3: $249,999	$49,999	-$10,000	-$10,000	-$10,000	$49,999	$12,199.63
P(state)	30%	14%	28%	21%	7%	

b)

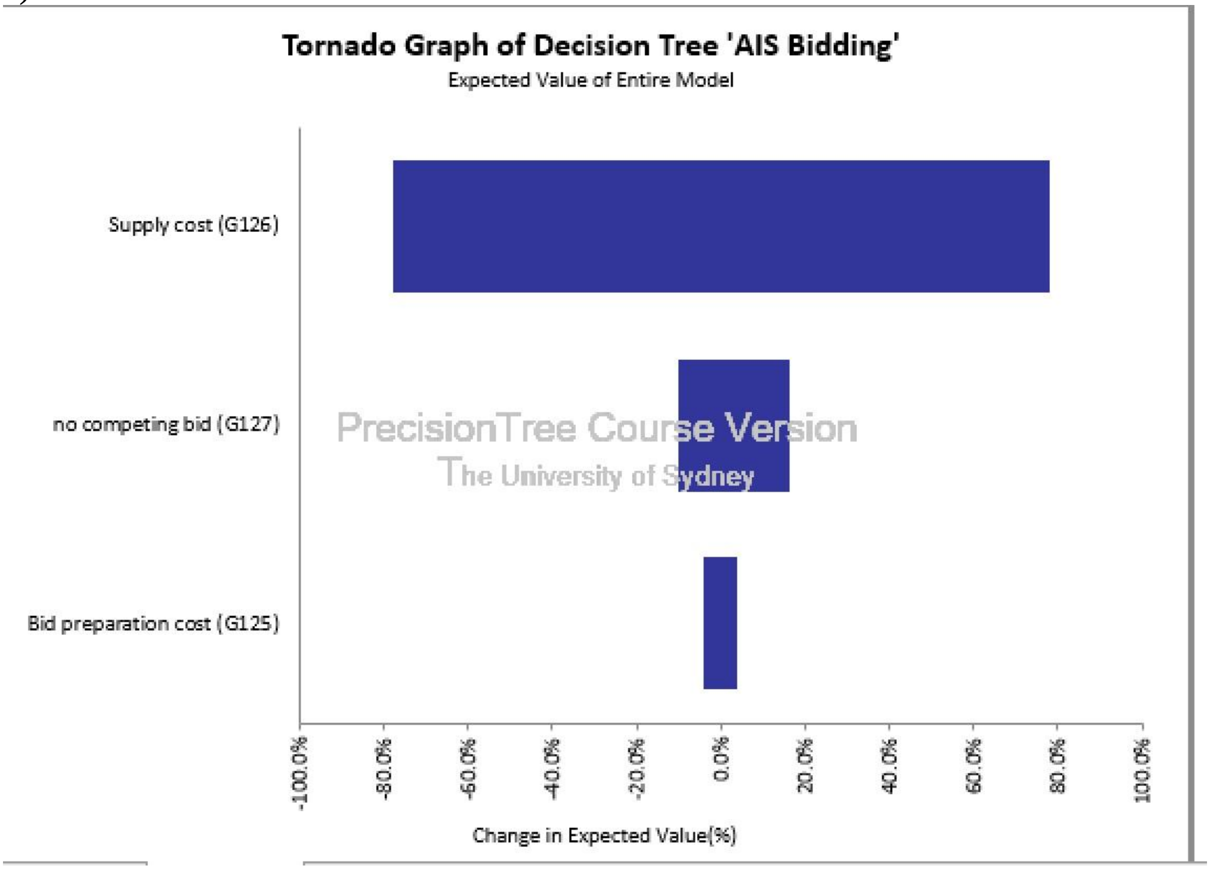
The decision tree that sets out the problem



c) the strategy that maximizes the EMV for IC is to place a bid of $229999 (which could also be $230,000, doesn’t make much difference). And the optimum value(EMV) is 24399.14.

2.2 This section focuses on the sensitivity

a)



Tornado Graph Data

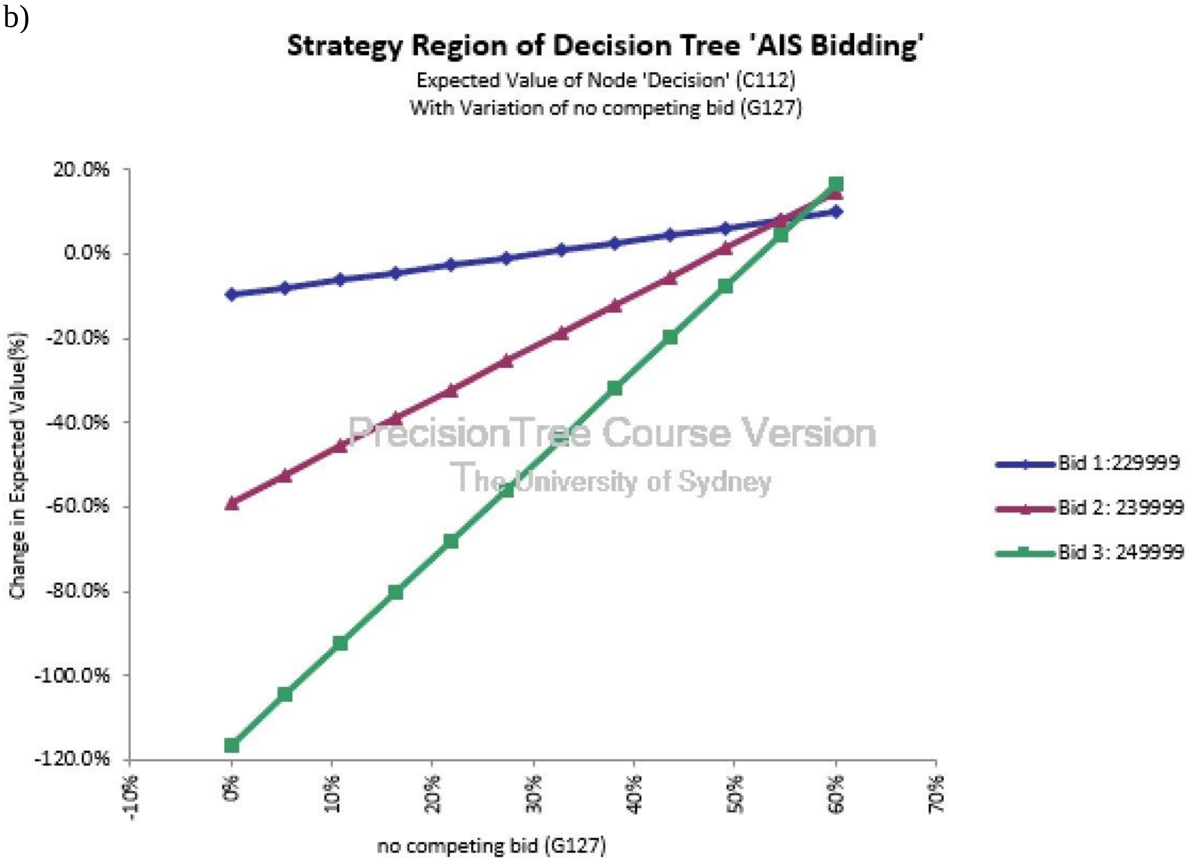
Decision Tree 'AIS Bidding' (Expected Value of Entire Model)

			Minimum			Maximum		
			Output		Input	Output		Input
Rank	Input Name	Cell	Value	Change (%)	Value	Value	Change (%)	Value
1	Supply cost (G126)	G126	5399.14	-77.87%	-209000	43399.14	77.87%	-171000
2	no competing bid (G127)	G127	21999.2	-9.84%	0	28399.36	16.39%	0.6
3	Bid preparation cost (G125)	G125	23399.14	-4.10%	-11000	25399.14	4.10%	-9000

Interpretation:

The supply cost has the most impact on (EMV) leading to fluctuations from a decrease of 77.87 % at a high of -209 000 to an increase of 77.87 % at a low of -171 000. The impact of having "No Competing Bid " falls in the range affecting EVM by a decrease of 9.84% at 0 % and an increase of 16.39 % at 60 %. Meanwhile the cost for bid preparation has the least influence on EVM changes ranging from a decrease of -04.10 % at -11 000 to an increase of +04.10% AT 9000.

b)



Strategy Region Data								
	Input		Bid 1:229999		Bid 2: 239999		Bid 3: 249999	
	Value	Change (%)	Value	Change (%)	Value	Change (%)	Value	Change (%)
#1	0%	-100.00%	21999.2	-9.84%	9999.6	-59.02%	-4000.1	-116.39%
#2	5%	-81.82%	22435.55273	-8.05%	11635.93091	-52.31%	-1054.694545	-104.32%
#3	11%	-63.64%	22871.90545	-6.26%	13272.26182	-45.60%	1890.710909	-92.25%
#4	16%	-45.45%	23308.25818	-4.47%	14908.59273	-38.90%	4836.116364	-80.18%
#5	22%	-27.27%	23744.61091	-2.68%	16544.92364	-32.19%	7781.521818	-68.11%
#6	27%	-9.09%	24180.96364	-0.89%	18181.25455	-25.48%	10726.92727	-56.04%
#7	33%	9.09%	24617.31636	0.89%	19817.58545	-18.78%	13672.33273	-43.96%
#8	38%	27.27%	25053.66909	2.68%	21453.91636	-12.07%	16617.73818	-31.89%
#9	44%	45.45%	25490.02182	4.47%	23090.24727	-5.36%	19563.14364	-19.82%
#10	49%	63.64%	25926.37455	6.26%	24726.57818	1.34%	22508.54909	-7.75%
#11	55%	81.82%	26362.72727	8.05%	26362.90909	8.05%	25453.95455	4.32%
#12	60%	100.00%	26799.08	9.84%	27999.24	14.76%	28399.36	16.39%

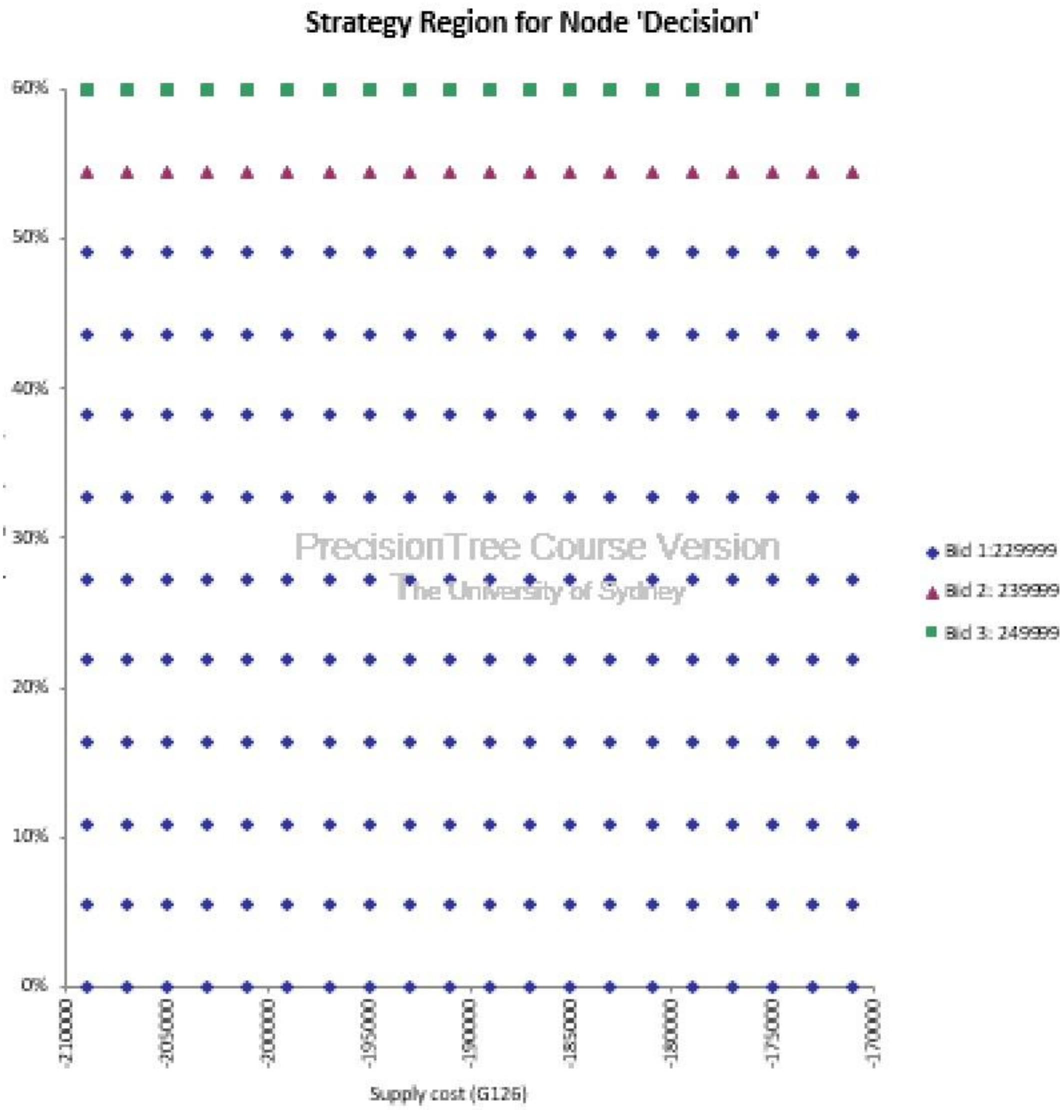
Interpretation of the Strategy Region Graph

- **Bid 1 ($229,999) - Blue Line:**
  - **Lowest Sensitivity to Probability Changes:** The blue line shows a relatively flat trend, indicating Bid 1's Expected Value (EV) is least sensitive to changes in the probability of no competing bids.
  - **Consistent EV Increase:** As the probability increases from 0% to 60%, Bid 1's EV improves steadily, from approximately $21,999 (at 0%) to $26,799 (at 60%).

- **Bid 2 ($239,999) - Purple Line:**
  - **Moderate Sensitivity to Probability Changes:** The purple line shows a steeper slope than Bid 1, indicating moderate sensitivity to probability changes.
  - **Increasing EV:** Bid 2 starts lower at 0% ($9,999) but surpasses Bid 1 around 33%. By 60%, its EV reaches $27,999, making it favorable at higher probabilities.

- **Bid 3 ($249,999) - Green Line:**
  - **Highest Sensitivity to Probability Changes:** The green line's steep slope indicates the highest sensitivity to changes in probability.
  - **Negative EV at Lower Probabilities:** Bid 3 starts with a negative EV (-$4,000) at 0%, becoming positive around 22% probability. At 60%, it has the highest EV at approximately $28,399.

c)



Strategy Region for Node 'Decision'
60%
50%
40%
30%
20%
10%
0%
-2100000
-2050000
-2000000
-1950000
-1900000
-1850000
-1800000
-1750000
-1700000
Supply cost (G126)
PrecisionTree Course Version
The University of Sydney
Bid 1:229999
Bid 2: 239999
Bid 3: 249999

Strategy Region Chart Data					
Bid 1:229999		Bid 2: 239999		Bid 3: 249999	
Supply cost (G126)	no competing bid (G127)	Supply cost (G126)	no competing bid (G127)	Supply cost (G126)	no competing bid (G127)
-209000	0%	-209000	55%	-209000	60%
-209000	5%	-207000	55%	-207000	60%
-209000	11%	-205000	55%	-205000	60%
-209000	16%	-203000	55%	-203000	60%
-209000	22%	-201000	55%	-201000	60%
-209000	27%	-199000	55%	-199000	60%
-209000	33%	-197000	55%	-197000	60%
-209000	38%	-195000	55%	-195000	60%
-209000	44%	-193000	55%	-193000	60%
-209000	49%	-191000	55%	-191000	60%
-207000	0%	-189000	55%	-189000	60%
-207000	5%	-187000	55%	-187000	60%
-207000	11%	-185000	55%	-185000	60%
-207000	16%	-183000	55%	-183000	60%
-207000	22%	-181000	55%	-181000	60%
-207000	27%	-179000	55%	-179000	60%
-207000	33%	-177000	55%	-177000	60%
-207000	38%	-175000	55%	-175000	60%
-207000	44%	-173000	55%	-173000	60%
-207000	49%	-171000	55%	-171000	60%
-205000	0%				
-205000	5%				

220	-175000	49%				
221	-173000	0%				
222	-173000	5%				
223	-173000	11%				
224	-173000	16%				
225	-173000	22%				
226	-173000	27%				
227	-173000	33%				
228	-173000	38%				
229	-173000	44%				
230	-173000	49%				
231	-171000	0%				
232	-171000	5%				
233	-171000	11%				
234	-171000	16%				
235	-171000	22%				
236	-171000	27%				
237	-171000	33%				
238	-171000	38%				
239	-171000	44%				
240	-171000	49%				

Interpretation:

Bid 1 ($229,999) is optimal at lower probabilities of no competing bids (0% to 49%) and all levels of high supply costs (-209,000 to -171,000). **Bid 2 ($239,999)** becomes optimal at a moderate probability of no competing bids (around 55%) with high supply costs (-209,000 to -189,000). **Bid 3 ($249,999)** dominates at the highest probability of no competing bids (60%), remaining the best choice regardless of supply cost fluctuations, showing less sensitivity to supply costs.

3.1) Investment attractiveness analysis

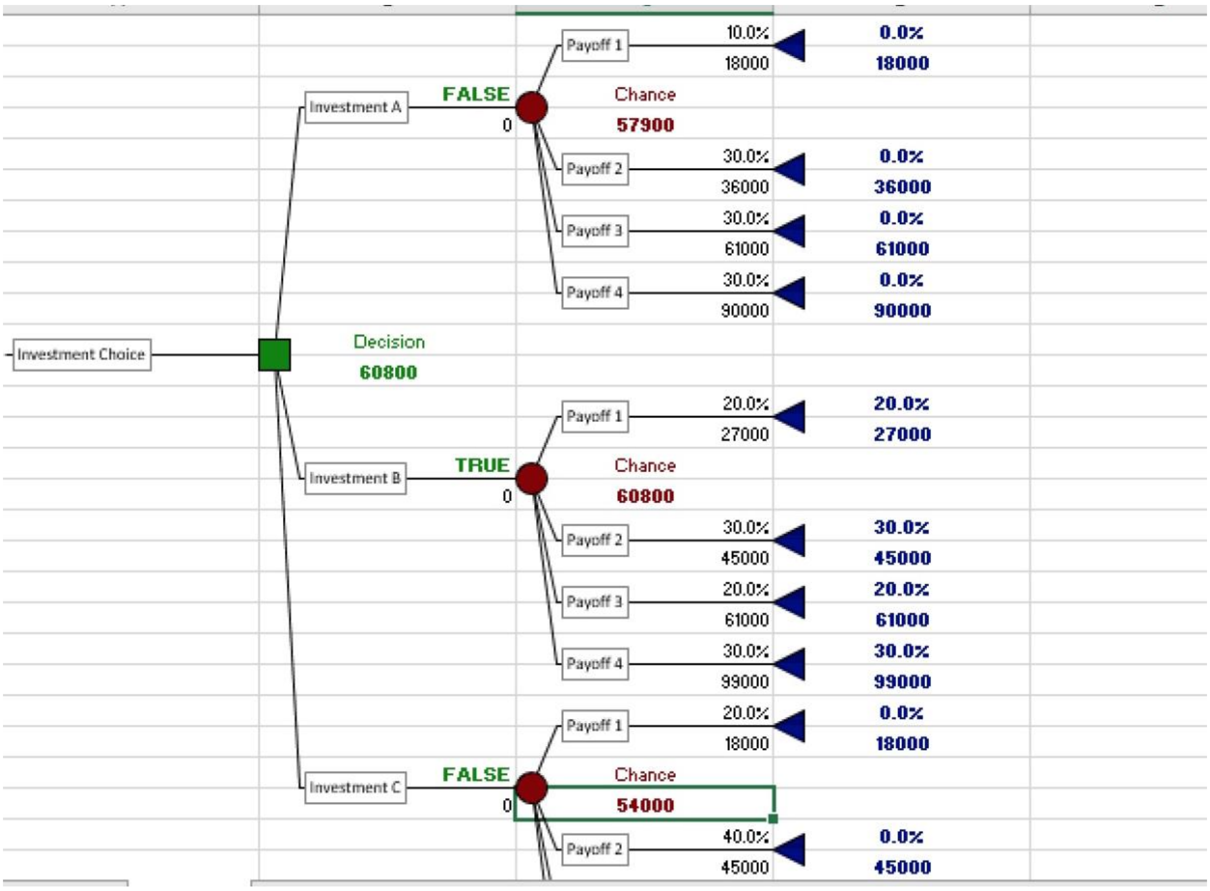
EMV and Standard Deviation

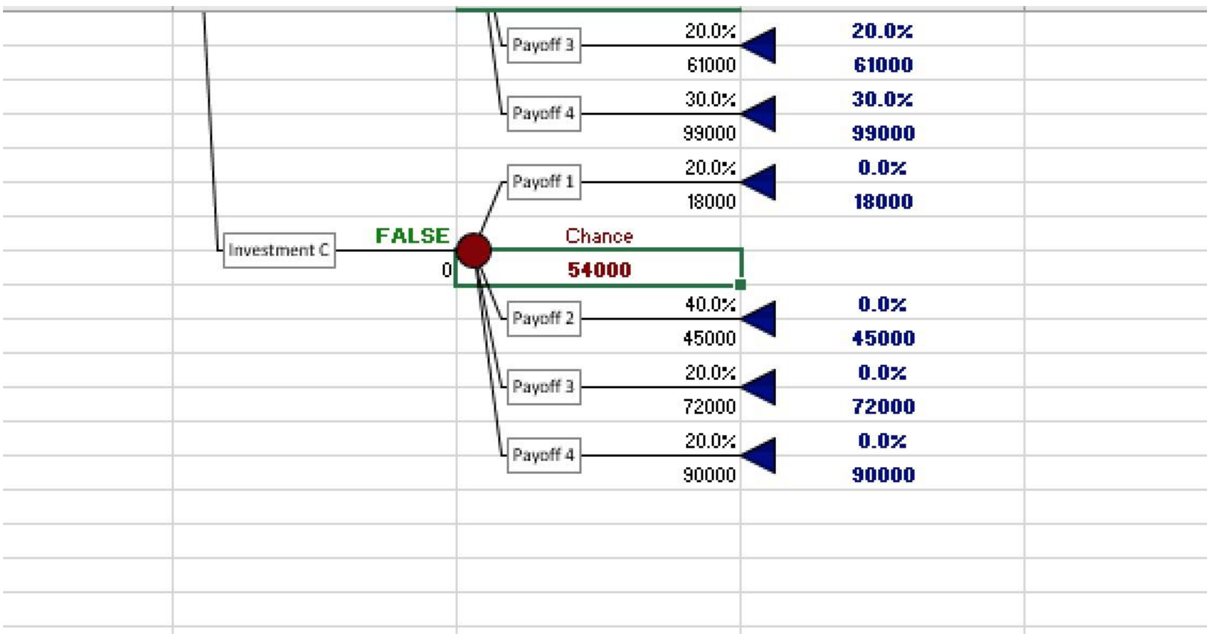
To begin the analysis, (EMV) for each investment was calculated to be: A: $57,900, B: $60,800, C: $54,000. These values guide risk assessment, dominance evaluation, and ranking for all investor types.

	Investment A		Investment B		Investment C	
Payoff		Probability		Probability		Probability
1	$18,000	10%	$27,000	20%	$18,000	20
2	$36,000	30%	$45,000	30%	$45,000	40
3	$61,000	30%	$61,000	20%	$72,000	20
4	$90,000	30%	$99,000	30%	$90,000	20
EMV	57900		60800		54000	
standard Deviation	24,801		$27,224		$24,811	

3.2) Decision Tree

The EMV indicates expected returns: Investment B is the highest ($60,800), with A ($57,900) and C ($54,000) following. B also has the greatest standard deviation ($27,224), suggesting higher risk, while A ($24,801) and C ($24,811) present lower risk. Risk-neutral investors likely choose B for its highest EMV; risk-averse investors might prefer A for lower risk, while risk-loving investors may still choose B for higher returns.





3.3) Risk Profile

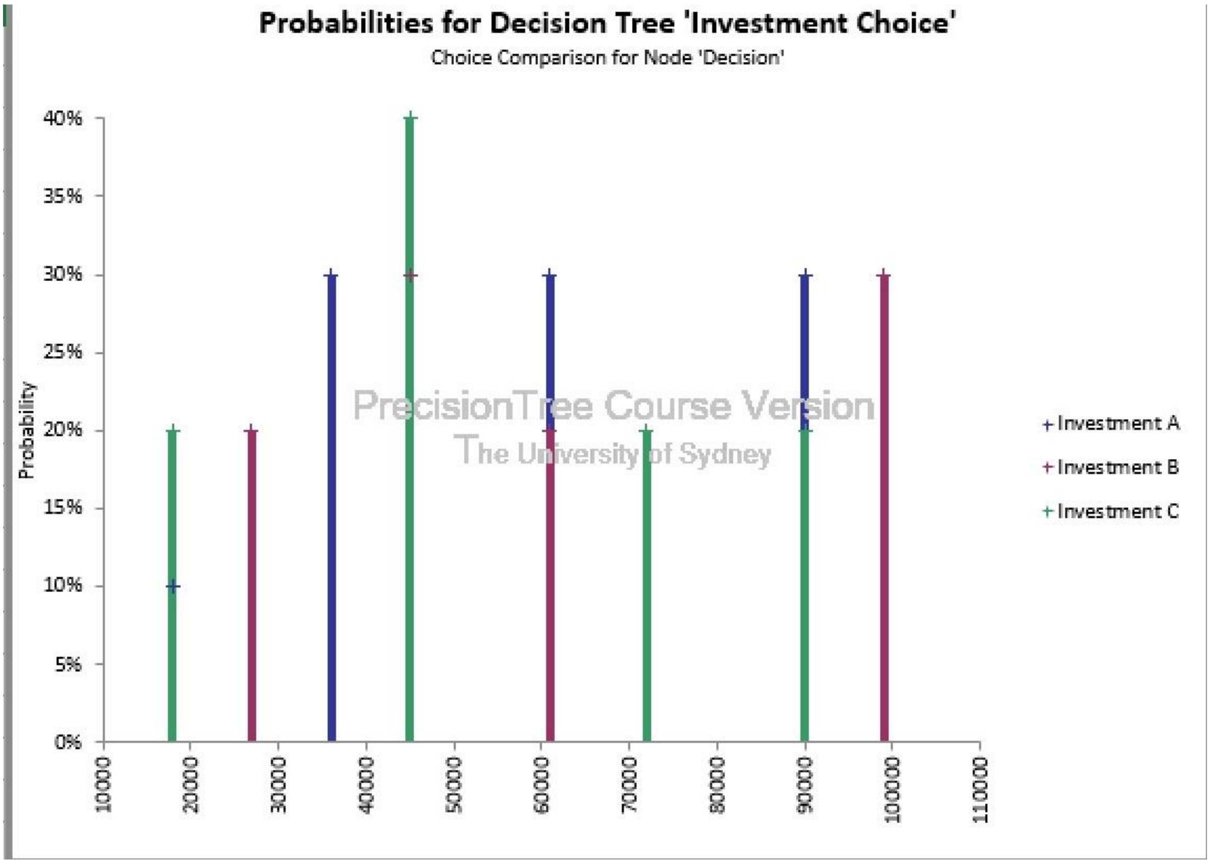


Chart Data						
	Investment A		Investment B		Investment C	
	Value	Probability	Value	Probability	Value	Probability
#1	18000	10.0000%	27000	20.0000%	18000	20.0000%
#2	36000	30.0000%	45000	30.0000%	45000	40.0000%
#3	61000	30.0000%	61000	20.0000%	72000	20.0000%
#4	90000	30.0000%	99000	30.0000%	90000	20.0000%

Using standard deviation/EMV, calculate the coefficient of variation (CV) to compare risk per unit of return: A = 42.83%, B = 44.77%, C = 45.95%. Investment A's lowest CV appeals to risk-averse investors.

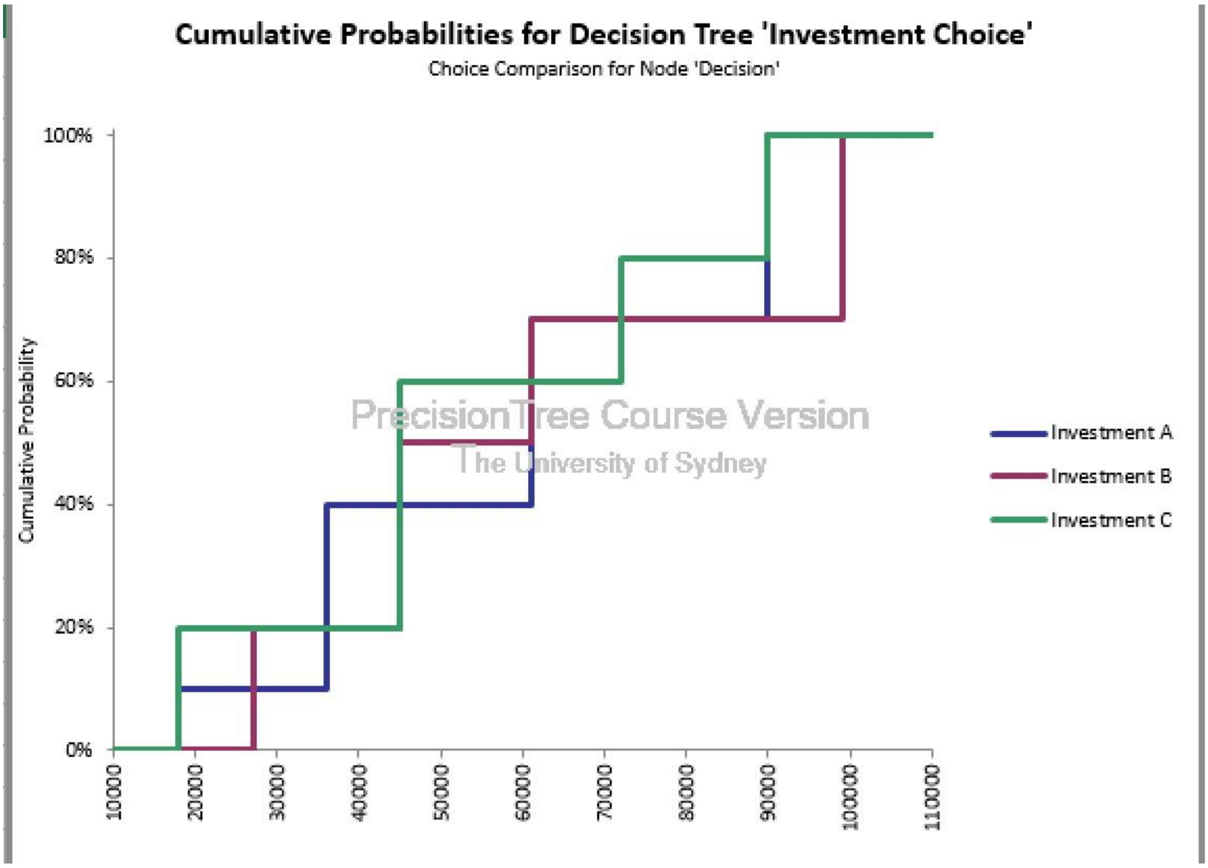


Chart Data						
	Investment A		Investment B		Investment C	
	Value	Probability	Value	Probability	Value	Probability
#1	-Infinity	0.0000%	-Infinity	0.0000%	-Infinity	0.0000%
#2	18000	0.0000%	27000	0.0000%	18000	0.0000%
#3	18000	10.0000%	27000	20.0000%	18000	20.0000%
#4	36000	10.0000%	45000	20.0000%	45000	20.0000%
#5	36000	40.0000%	45000	50.0000%	45000	60.0000%
#6	61000	40.0000%	61000	50.0000%	72000	60.0000%
#7	61000	70.0000%	61000	70.0000%	72000	80.0000%
#8	90000	70.0000%	99000	70.0000%	90000	80.0000%
#9	90000	100.0000%	99000	100.0000%	90000	100.0000%
#10	Infinity	100.0000%	Infinity	100.0000%	Infinity	100.0000%

FSD interpretation:

Since all three CDFs intersect, FSD cannot exist, even though Investment A has a cumulative probability less than or equal to B and C for every return level.

- At18,000:A(10%)<B(20%)
- At36,000:A(40%)<B(50%)
- At61,000:A(70%)<B(80%)
- At99,000:A(100%)=B(100%)
- **Investment A** has a lower cumulative probability than B at all levels except the maximum, where they are equal.

- **Investment A vs. Investment C:**

- At18,000:A(10%)<C(20%)
- At36,000:A(40%)<C(60%)
- At61,000:A(70%)<C(80%)
- At99,000:A(100%)=C(100%)
- **Investment A** has a lower cumulative probability than C at all levels except the maximum, where they are equal.

- **Investment B vs. Investment C:**

- At 18,000: B (20%) = C (20%)
- At 36,000: B (50%) < C (60%)
- At 61,000: B (80%) = C (80%)
- At 99,000: B (100%) = C (100%)
- **Investment B** is not strictly less than C at any level.

SSD interpretation:

Area Between CDFs of A and B:

- From 0 to 18000:

Area=(18000-0)*(0.1 - 0.2)=18000*(-0.1)=-1800

- From 18000 to 27000:

Area=(27000-18000) * (0.1 - 0.2) = 9000 * (-0.1) = -900

- From 27000 to 36000:

Area = (36000 - 27000) * (0.4 - 0.2) = 9000 * 0.2 = 1800

- From 36000 to 45000:

Area = (45000 - 36000) * (0.4 - 0.5) = 9000 * (-0.1) = -900

- From 45000 to 61000:

Area = (61000 - 45000) * (0.7 - 0.7) = 16000 * 0 = 0

- From 61000 to 90000:

Area = (90000 - 61000) * (1.0 - 0.7) = 29000 * 0.3 = 8700

- From 90000 to 99000:

Area = (99000 - 90000) * (1.0 - 1.0) = 9000 * 0 = 0

Cumulative SSD Areas for A and B:

- Sum = -1800 - 900 + 1800 - 900 + 0 + 8700 + 0 = 6900

Since the cumulative area is positive at all intervals, Investment A does not dominate B by SSD.

Area Between CDFs of B and C:

1. **From 0 to 18000**:
   - Difference in cumulative probabilities = (0.0 - 0.2) = -0.2
   - Area = (18000 - 0) * (-0.2) = 18000 * (-0.2) = -3600 (negative area)
2. **From 18000 to 27000**:
   - Difference in cumulative probabilities = (0.2 - 0.2) = 0
   - Area = (27000 - 18000) * (0) = 9000 * 0 = 0
3. **From 27000 to 45000**:
   - Difference in cumulative probabilities = (0.5 - 0.6) = -0.1
   - Area = (45000 - 27000) * (-0.1) = 18000 * (-0.1) = -1800 (negative area)
4. **From 45000 to 61000**:
   - Difference in cumulative probabilities = (0.7 - 0.8) = -0.1
   - Area = (61000 - 45000) * (-0.1) = 16000 * (-0.1) = -1600 (negative area)
5. **From 61000 to 72000**:
   - Difference in cumulative probabilities = (0.7 - 0.8) = -0.1
   - Area = (72000 - 61000) * (-0.1) = 11000 * (-0.1) = -1100 (negative area)
6. **From 72000 to 90000**:
   - Difference in cumulative probabilities = (1.0 - 0.8) = 0.2
   - Area = (90000 - 72000) * (0.2) = 18000 * 0.2 = 3600 (positive area)
7. **From 90000 to 99000**:
   - Difference in cumulative probabilities = (1.0 - 1.0) = 0
   - Area = (99000 - 90000) * 0 = 9000 * 0 = 0

Cumulative SSD Calculation for Investments B and C:

Now, let's compute the cumulative area:

- **Cumulative Area Calculation:**
  - From 0 to 18000: -3600
  - From 18000 to 27000: -3600 + 0 = -3600
  - From 27000 to 45000: -3600 - 1800 = -5400
  - From 45000 to 61000: -5400 - 1600 = -7000
  - From 61000 to 72000: -7000 - 1100 = -8100
  - From 72000 to 90000: -8100 + 3600 = -4500
  - From 90000 to 99000: -4500 + 0 = -4500

The final cumulative area is **-4500**, which is negative.

Conclusion for SSD Between Investments B and C

Since the cumulative area is negative throughout the range, **Investment B does not dominate Investment C by SSD**. SSD requires that the cumulative area difference must be non-negative for all intervals. In this case, the cumulative area becomes negative, indicating that Investment B does not dominate Investment C.

Implication

Investment C is preferable under SSD for risk-averse investors because it has less cumulative downside risk compared to Investment B. Risk-averse investors might prefer Investment C over Investment B based on SSD.

Area Between CDFs of B and C:

1. **From 0 to 18000**:
   - Difference in cumulative probabilities = (0.0 - 0.2) = -0.2
   - Area = (18000 - 0) * (-0.2) = 18000 * (-0.2) = -3600 (negative area)
2. **From 18000 to 27000**:
   - Difference in cumulative probabilities = (0.2 - 0.2) = 0
   - Area = (27000 - 18000) * (0) = 9000 * 0 = 0
3. **From 27000 to 45000**:
   - Difference in cumulative probabilities = (0.5 - 0.6) = -0.1
   - Area = (45000 - 27000) * (-0.1) = 18000 * (-0.1) = -1800 (negative area)
4. **From 45000 to 61000**:
   - Difference in cumulative probabilities = (0.7 - 0.8) = -0.1
   - Area = (61000 - 45000) * (-0.1) = 16000 * (-0.1) = -1600 (negative area)
5. **From 61000 to 72000**:
   - Difference in cumulative probabilities = (0.7 - 0.8) = -0.1
   - Area = (72000 - 61000) * (-0.1) = 11000 * (-0.1) = -1100 (negative area)
6. **From 72000 to 90000**:
   - Difference in cumulative probabilities = (1.0 - 0.8) = 0.2
   - Area = (90000 - 72000) * (0.2) = 18000 * 0.2 = 3600 (positive area)
7. **From 90000 to 99000**:
   - Difference in cumulative probabilities = (1.0 - 1.0) = 0
   - Area = (99000 - 90000) * 0 = 9000 * 0 = 0

Cumulative SSD Calculation for Investments B and C:

Now, let's compute the cumulative area:

- **Cumulative Area Calculation:**
  - From 0 to 18000: -3600
  - From 18000 to 27000: -3600 + 0 = -3600
  - From 27000 to 45000: -3600 - 1800 = -5400
  - From 45000 to 61000: -5400 - 1600 = -7000
  - From 61000 to 72000: -7000 - 1100 = -8100
  - From 72000 to 90000: -8100 + 3600 = -4500
  - From 90000 to 99000: -4500 + 0 = -4500

The final cumulative area is **-4500**, which is negative.

Conclusion for SSD Between Investments B and C

Since the cumulative area is negative throughout the range, **Investment B does not dominate Investment C by SSD**. SSD requires that the cumulative area difference must be non-negative for all intervals. In this case, the cumulative area becomes negative, indicating that Investment B does not dominate Investment C.

Implication

Investment C is preferable under SSD for risk-averse investors because it has less cumulative downside risk compared to Investment B. Risk-averse investors might prefer Investment C over Investment B based on SSD.

Statistics	Investment A	Investment B	Investment C
Mean	57900	60800	54000
Minimum	18000	27000	18000
Maximum	90000	99000	90000
Mode	N/A	N/A	45000
Std. Deviation	24801.00804	27224.25389	24811.28775
Skewness	0.0281	0.3874	0.0573
Kurtosis	1.6943	1.6722	1.8352

Skewness Analysis

Investment A: Skewness = 0.0281 (approximately symmetric)

Investment B: Skewness = 0.3874 (slightly positively skewed, more mass on the left)

Investment C: Skewness = 0.0573 (near symmetric, slightly positive)

Interpretation: All investments are relatively symmetric, but Investment B's slight positive skew suggests a marginally higher chance of above-average returns, appealing to moderate risk-takers.

Kurtosis Analysis:

Investment A: Kurtosis = 1.6943 (less peaked, lighter tails)

Investment B: Kurtosis = 1.6722 (less peaked, lighter tails)

Investment C: Kurtosis = 1.8352 (closer to normal, less peaked)

Interpretation: Low kurtosis indicates few extreme outcomes; Investment C, closest to normal, might appeal to moderate risk-seekers favoring balanced returns.

Minimum and Maximum Values Analysis:

Minimum Value: Investment B has a higher minimum payoff ($27,000), offering more downside protection than A and C ($18,000).

Maximum Value: Investment B provides the highest maximum payoff ($99,000), appealing to risk-loving investors.

Risk-Return Ratio (Sharpe Ratio)

To assess the risk-adjusted return, we calculate the **Sharpe Ratio** (assuming a risk-free rate of 0):

$\text{Sharpe Ratio}=\text{Mean}-\text{RiskFree Rate}/\text{Standard Deviation}$

- **Investment A:**

  $\text{Sharpe Ratio}_A=57{,}900-0/24{,}801\approx 2.33$

- **Investment B:**

  $\text{Sharpe Ratio}_B=60{,}800-0/27{,}224\approx 2.23$

- **Investment C:**

  $\text{Sharpe Ratio}_C=54{,}000-0/24{,}811\approx 2.18$

Interpretation:

- **Investment A** has the highest Sharpe Ratio (2.33), suggesting it provides the highest risk-adjusted return, which is desirable for both risk-neutral and risk-averse investors.
- **Investment C** has the lowest Sharpe Ratio (2.18), making it the least favorable in terms of risk-adjusted returns.

Final analysis:

For **risk-averse investors**, Investment C is preferable over B due to Second-Order Stochastic Dominance (SSD), while Investment A is attractive for its lowest Coefficient of Variation (CV) (42.83%), indicating the least risk per return unit. No SSD dominance exists between A and B or A and C. **Risk-neutral investors** focus on maximizing Expected Monetary Value (EMV), with Investment B, having the highest EMV ($60,800), as the primary choice, despite no clear First-Order Stochastic Dominance (FSD) among the investments due to intersecting CDFs. **Risk-loving investors** prefer Investment B for its higher EMV and maximum return ($99,000), and its higher standard deviation ($27,224), aligning with their preference for higher risk. **Dominance evaluation** shows no Deterministic Dominance (DD) or FSD among investments; however, SSD favors Investment C over B. Investment A's lowest CV makes it attractive for risk-averse investors, while B appeals to risk-neutral and risk-loving investors for its returns.

Conclusion and Ranking of Investments

Investment C ranks highest for risk-averse investors due to its SSD dominance over Investment B, while Investment A is also attractive for its lower CV. Investment B ranks highest for risk-neutral investors due to its highest EMV and for risk-loving investors because of its potential for maximum returns. Investment A does not dominate under SSD or FSD criteria but remains appealing to risk-averse investors for its low CV. The final ranking is: 1) Investment B for risk-neutral and risk-loving investors, 2) Investment C for risk-averse investors, and 3) Investment A for those preferring the lowest risk per unit of return. This ranking considers all risk types and integrates precise dominance calculations.

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