



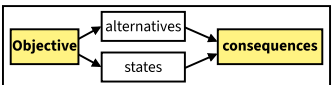
Full guide + ask SIA
about MGMT20005

0 • Exam map

COURSE FACTS

Individual 25%	Group 25%	Exam 50%
ASSESSMENT	FORMAT	WT
Individual assignment	1500 words (equivalent)	25%
Group assignment	Groups of 3 students · 2500 words	25%
End-of-semester examination	2 hours	50%

"This is an open-book exam, which means you can bring 2 pages handwritten or typed notes related to the subject to the exam venue." (MGMT20005 assessments information, 2026)



Build first: objective fixes direction; each alternative–state pair needs one comparable consequence.

1 • Choose the method

W1–W7

PROMPT GIVES	USE
Payoffs; no probabilities	Maximax / maximin / minimax regret
Probabilities or timing	EV + decision tree + rollback
Forecast/report	Bayes; EVSI / EVPI
Several criteria	Weighted score or AHP
Best allocation under limits	LP; corner points / Solver
Solved LP + "what if?"	Sensitivity report

EXAM MOVE Before arithmetic: name objective, controllable choices, uncertainty/information, units and requested output.

1b • Model-answer spine

COURSE FAQ

- Recognise:** identify the model from the information structure, not from a keyword alone.
- Represent:** draw the table/tree/hierarchy/LP; label symbols and units.
- Calculate:** keep intermediate joints, node values, corners or report ranges visible.
- Check:** probability totals, reciprocity, feasibility, domains and allowable ranges.
- Recommend:** action + computed basis + assumption or material downside.

OBJECT	WHAT THE EXAMINER CAN AUDIT
Payoff model	Same states, units and horizon in every cell
Probability model	Complete branches; conditional direction shown
Multi-criteria model	Weights/priorities separated from ratings
Optimisation model	Variables, objective, every constraint, domains

2 • No probabilities

W1

RULE	PROFIT TABLE	COST TABLE
Optimistic	Row max → largest	Row min → smallest
Protective	Row min → largest	Row max → smallest
Minimax regret	Best state profit – payoff	Cost – cheapest state cost

PROFIT REGRET
 $r_{ij} = \max_i(\text{payoff}_{ij}) - \text{payoff}_{ij}$
Choose i with $\min_i[\max_j(r_{ij})]$

COST REGRET
 $r_{ij} = \text{cost}_{ij} - \min_i(\text{cost}_{ij})$
Regrets must be ≥ 0 .



Different rules encode different attitudes; disagreement is not an arithmetic contradiction.

REPRESENTATION TEST

Payoff table: one choice across common states. **Tree:** timing, conditional events or later choices. **Influence diagram:** compact dependency picture, not a rollback calculation.

TRAP *Never invent equal probabilities. Put **PROFIT** or **COST** above the table before any max/min.*

2b • Rule execution

W1 FAQ

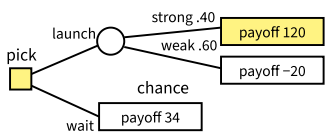
- Confirm one objective and one common unit/time horizon.
- List actions in rows and uncontrollable states in columns.
- For maximax/maximin, write the relevant row summary beside every action before selecting.
- For regret, write the best state benchmark above each column; subtract in the direction that keeps regret non-negative.
- Take each row's maximum regret, then choose the smallest of those maxima.

CLAIM	CORRECT INTERPRETATION
Maximax selects A	A has the most attractive possible consequence
Maximin selects B	B has the best protected worst consequence
Minimax regret selects C	C limits the largest state-specific missed opportunity

Why answers differ: each rule optimises a different summary. None predicts the realised state. State the criterion and decisive value; do not call one rule universally "best".

3 • Trees & expected value

W2



Square = choose; circle = probability-weighted average; terminal = complete path payoff.

CHANCE NODE
 $EV = \sum p_j v_j$, with $\sum p_j = 1$

PATH PROBABILITY
 $P(A \text{ then } B) = P(A) \times P(B | A)$

- Draw time left → right; distinguish squares and circles.
- Put probability on every chance branch; siblings are mutually exclusive and collectively exhaustive.
- Put all local costs/benefits into terminal payoffs.
- Roll back right → left:** average at circles; select best objective branch at squares.
- Mark the retained contingent strategy; then form its risk profile.

OUTPUT	MEANING
Expected value	Comparison average; not a guaranteed payoff
Risk profile	Each possible realised payoff + probability
Recommendation	Chosen branch, EV basis, material downside

NODE CHECK *If you maximise at a circle or average at a square, the rollback is wrong.*

3b • Tree audit & risk

W2 FAQ

CHECK	REQUIRED EVIDENCE
Structure	Later choice only after information actually observed
Probabilities	Siblings sum to 1; multiply successive conditional events along a path
Payoffs	Terminal value includes every local cost and benefit once
Rollback	Chance EV beside circle; retained branch marked at square
Strategy	Complete "if report/event..., then choose..." policy

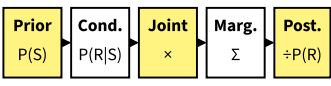
A **risk profile** is the probability distribution of terminal payoffs generated by the retained strategy. Combine identical payoffs by adding probabilities of mutually exclusive paths; verify the final probabilities sum to one. Compare downside, spread or liquidity exposure without changing the EV arithmetic.

Conditional-path rule: multiply when every event on the same path must occur. Add only mutually exclusive paths when finding a report probability, a repeated payoff probability, or a complete total.

CLOSE *"Choose [branch] under expected value because EV=... versus ...; however, the strategy still exposes the business to [specific endpoint]."*

4 • Information & Bayes

W3



Keep directions visible: $P(\text{report} | \text{state})$ is not $P(\text{state} | \text{report})$.

BAYES
 $P(S_i | R) = P(S_i)P(R | S_i)$
 $P(R) = \sum_i P(S_i | R)P(R)$
 $P(S_i | R) = P(S_i | R) / P(R)$

PERFECT INFORMATION
 $EV_{wPI} = \sum_j p_j [\max_i \text{payoff}_{ij}]$
 $EVPI = EV_{wPI} - \max_i EV_i \geq 0$



EVPI is the ceiling: imperfect information cannot be worth more.

SAMPLE INFORMATION
For each report r : update → choose best action.
 $EV_{wSI} = \sum_r P(r) [\text{best conditional EV after } r]$
 $EVSI = EV_{wSI} - \text{best EV without information}$

Fee: compare fee with gross EVSI, or deduct it once from EV_{wSI} . Information can have zero value even if probabilities move: if every report leaves the same action best, there is no decision improvement.

4b • Information workflow

W3

LAYER	OPERATION	OUTPUT
No information	EV each fixed action	Best baseline EV
Perfect information	Best action inside each state; then weight states	EV_{wPI} ; EVPI ceiling
Sample information	Bayes update inside each report; optimise action	Contingent policy
Outer average	Weight retained report-branch EVs by $P(\text{report})$	EV_{wSI} ; EVSI

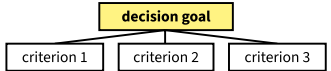
- For each report separately, calculate every state–report joint and the report marginal.
- Divide joints by that report's marginal; posterior states under the report sum to one.
- Recalculate action EVs using those posteriors; choose locally.
- Weight those locally best EVs by report probabilities; report probabilities also sum to one.

Sanity chain: $EV_{wPI} \geq EV_{wSI} \geq \text{best EV without information}$; hence $EVPI \geq EVSI \geq 0$. If the chain fails, check whether the action was optimised within each report and whether the fee was deducted twice.

5 • Scoring & AHP

W4

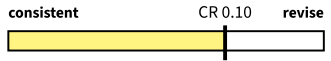
DIRECT SCORING	AHP
Weights and ratings supplied directly	Priorities derived from pairwise judgments
$\text{Score}_i = \sum_j w_j r_{ij}$	Reciprocal matrices; consistency checked



compare alternatives by criterion
Derive criterion priorities, local alternative priorities, then recombine.

- Build A: $a_{ii}=1$ and $a_{ji}=1/a_{ij}$.
- Sum each column; divide each entry by its column total.
- Average each normalised row → priority w ; check $\sum w=1$.
- Using original A: compute Aw ; ratios $(Aw)_i/w_i$; average → λmax .
- Compute CI and CR. Only then combine local priorities.

CONSISTENCY
 $CI = (A_{\text{max}} - n) / (n - 1)$
 $CR = CI / RI_n$
Course rule: $CR < 0.10$ acceptable; $CR > 0.10$ revise.



A high CR diagnoses contradictory judgments; do not force the ranking.

REPORTING *Preserve decimals until the final rank; if scores are close, name the contribution or contested weight that could reverse them.*

5b • Combine priorities

W4

OVERALL AHP PRIORITY
Overall priority of alternative $i = \sum_j (\text{criterion priority}_j \times \text{local priority}_{ij})$

STAGE	MUST SUM TO 1
Criterion comparison	Criterion priority vector
Alternatives under criterion j	Local alternative priorities for j
Final synthesis	Overall alternative priorities

Weighted scoring: multiply each given weight × rating, then sum across criteria. **AHP:** derive priorities from reciprocal comparisons, test consistency, then synthesise.

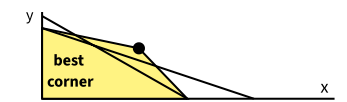
Reciprocity: if item A is 3 times item B, reverse entry = 1/3. Fill one triangle, reflect reciprocals, keep diagonal entries 1. Rounding can slightly disturb totals; retain at least four decimals until the final result.

6 • LP + sensitivity

W5–W7

GENERIC LP
Choose x_j (meaning + unit + period).
 $\text{Max/min } z = \sum_j c_j x_j$
s.t. $\sum_j a_{ij} x_j \leq, = \text{ or } \geq b_i$; domains.

PHRASE	TRANSLATE
At most / capacity	$LHS \leq RHS$
At least / requirement	$LHS \geq RHS$
Balance / conservation	$\text{inflow} = \text{outflow}$
$x \geq 30\%$ of total	$x \geq .30(x+y)$



For two variables; shade all half-planes, list feasible vertices, evaluate z at every corner.

VALIDITY CHECKS

Linear means fixed coefficient × one variable: no variable products, powers or nonlinear functions. Substitute a proposed solution into every constraint; feasibility is not optimality. **Binding:** $LHS=RHS$. **Slack:** $RHS-LHS$ for $\leq$. Infeasible = no common point; unbounded = no finite improving limit—first audit signs, directions and missing bounds.

Objective c: same x ; recalc z
RHS: same price; x may change

Range of optimality and range of feasibility certify different invariants.

LOCAL RHS CHANGE
 $\Delta z = \text{shadow price} \times \Delta RHS$, only inside RHS range.

FIELD	USE
Reduced cost	Coefficient improvement for a zero variable to enter
Shadow price	Local value of one more RHS unit

RE-SOLVE *Outside a range; unsupported simultaneous change; changed constraint coefficient; or changed structure.*

7 • Flow applications

W7

Opening inventory _{t} + Production _{t} = Demand _{t} + Ending inventory _{t}
Opening inventory _{$t+1$} = Ending inventory _{t}

SETTING	CONSERVED FLOW / KEY INDEX
Production	Units and capacity by product, period
Inventory	Opening + production = demand + ending
Portfolio	Available cash funds purchases; maturity returns cash at later node
Media	Budget/placements by channel; relative mix rules

W1 • Launch rules

W1 WORKED

ALTERNATIVE	WEAK	STRONG
Pilot	42	56
Regional	18	92
National	-34	138

MAXIMAX

56/92/138 → National

MAXIMIN

42/18/-34 → Pilot

REGRET

82/46/76 → Regional

Same data, three management attitudes, three defensible choices.

REGRET MATRIX			
State benchmarks: weak = 42; strong = 138.			
	WEAK REGRET	STRONG REGRET	ROW MAX
Pilot	0	82	82
Regional	24	46	46
National	76	0	76

Answer: National under maximax; Pilot under maximin with protected payoff 42; Regional under minimax regret with worst regret 46.

TRAP Regret benchmarks are column-by-column states, never row-by-row alternatives.

Fast recall • cost

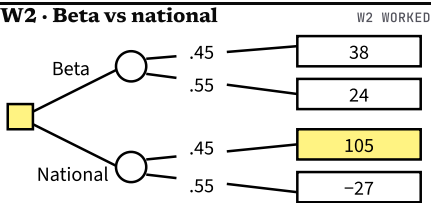
W1

Optimistic cost: choose smallest row minimum.
Protective cost: choose smallest row maximum.
Regret: cost – state minimum; minimise maximum regret.

LINE TO SHOW	WHY IT EARNS CLARITY
Objective: max profit / min cost	Fixes every comparison direction
Row summary beside each action	Makes criterion auditable
State benchmark above each column	Prevents row-based regret
Criterion + decisive number	Completes recommendation

Validation: profit-regret entries equal state maximum minus payoff; cost-regret entries equal cost minus state minimum. Every regret is zero for at least one action in each state and never negative. The selected action minimises its maximum regret, not its sum.

Representation choice: use a payoff table for one present decision across common states. Move to a tree when later decisions depend on earlier events, probabilities attach to sequential branches, or timing changes the available strategy.



Outcomes are receptive (.45) and cautious (.55); roll back at each circle.

EV(Beta) = .45(38) + .55(24) = 17.10 + 13.20 = **30.30**

EV(National) = .45(105) + .55(-27) = 47.25 - 14.85 = **32.40**

Decision: National under EV because 32.40 exceeds 30.30 by 2.10. The risk profile still contains 105 (.45) and -27 (.55); **32.40 is not a realised payoff.**

AUDIT	EVIDENCE
Complete chance set?	.45+.55=1
Operation?	Average at both circles
Decision?	Choose larger EV at square
Risk named?	Possible loss of 27

WRITE "Under an expected-value criterion..." if the manager could reasonably reject the higher EV because of downside or survival constraints.

Tree construction marks

W2

Distinct node shapes · chronological branches · conditional labels · probabilities · full terminal payoffs · chance-node EVs · retained branches · final contingent strategy.

OPERATION	SIGNAL	CHECK
Multiply	Successive events on one path	Use conditional probability where supplied
Add	Mutually exclusive paths combined	Do not double-count overlapping events
Average	Chance node	Sibling probabilities total 1
Optimise	Decision node	Direction matches objective

Risk profile: after retaining the strategy, list each terminal payoff and its path probability. If different paths end at the same payoff, add their mutually exclusive probabilities. The profile—not the EV alone—supports discussion of downside, liquidity or survival risk.

Timing discipline: a decision branch can depend only on information observed before that decision. A tree that lets management choose after learning an unobserved state overstates value and behaves like perfect information.

Final check: name the retained strategy, its root EV and one material endpoint from its risk profile.

AUDIT BACKWARDS Trace any unexpected root value from terminal payoff → chance-node arithmetic → retained decision branch.

W3 • Warning update

W3 WORKED

STATE	PRIOR	P(WARN STATE)	JOINT	POSTERIOR
Volatile	.30	.80	.24	.6316
Stable	.70	.20	.14	.3684
Total	1	—	.38	1

.30 × .80
= .24

.70 × .20
= .14

P(W)=
.38

.24/.38
= .6316

.14/.38
= .3684

- Joints share the same report marginal denominator.
- VolatilenWarning = .30(.80)=.24.
 - StablenWarning = .70(.20)=.14.
 - P(Warning)=.24+.14=.38.
 - P(Volatile|Warning)=.24/.38=.6316; P(Stable|Warning)=.3684.

Interpret: Warning raises volatile-demand probability from .30 to .6316, but does not establish volatility with certainty.

DIRECTION TEST Inputs are P(report / state); outputs are P(state / report). Posteriors for one report must sum to 1.

Information-value order

W3

report r

update P(state|r)

choose best

outer average over report probabilities → EVwSI

Write the policy conditionally: best action after each possible report.

QUANTITY	SUBTRACT	MEANING
EVPI	EVwPI – baseline	Perfect-information ceiling
EVSI	EVwSI – baseline	Gross value of imperfect report
Net value	EVSI – fee	Acquire only if benefit covers cost

Contingent strategy: calculate an action EV inside each report using that report's posterior probabilities; retain the best action locally. Then average those retained branch values using report probabilities. Using state priors at the outer layer mixes levels.

Zero-value test: if the same action stays optimal after every report, EVSI=0 even when posteriors differ. The report has changed belief but not the decision.

Ceiling test: EVSI cannot exceed EVPI. Sample information does not reveal the state perfectly, so it cannot rationally command a larger gross price than perfect information about the same uncertainty. Keep report labels attached to every posterior and retained action so the outer expectation can be audited branch by branch.

FEE TRAP Keep EVSI gross through comparison; if the tree already includes the fee, do not subtract it again.

W4 • AHP matrix

W4 WORKED

Rows R,C,S: [1, 2, 4], [1/2, 1, 2], [1/4, 1/2, 1].

	R	C	S	PRIORITY
R	1	2	4	.5714
C	.5	1	2	.2857
S	.25	.5	1	.1429
Σ col	1.75	3.50	7.00	1

sum columns

divide by col sum

average rows

w=(.5714,.2857,.1429)

All three normalised columns are identical in this consistent matrix.

Aw ≈ (1.7142, .8571, .4287)
(Aw)_i/w_i = (3, 3, 3) → λmax=3
CI=(3-3)/(3-1)=0
RI(3) = .58 → CR=0/.58=0

Answer: Reliability > Cost > Speed. CR=0<.10, so judgments are perfectly consistent.

MATRIX AUDIT Diagonal=1; opposite cells reciprocal; priorities sum to 1. Use the original matrix for Aw.

Scoring shortcut

W4

Keep criterion weights separate from performance ratings. Show each w_j r_{ij} contribution; do not multiply a rating by the wrong criterion weight. For a narrow lead, report sensitivity to the contested weight.

AUDIT	SCORING	AHP
Inputs	Given weights + ratings	Reciprocal judgments
Within criterion	Rating scale used consistently	Local priorities sum to 1
Across criteria	Weights sum to 1	Criterion priorities sum to 1
Quality test	Weight sensitivity	CR before synthesis

Full AHP synthesis: repeat the pairwise-priority calculation for criteria and for alternatives under every criterion. Multiply each local alternative priority by its criterion priority; sum across criteria. Final alternative priorities should sum to one.

Consistency sequence: original A × w → weighted-sum vector; divide componentwise by w; average ratios → λmax; then CI and CR. Do not use the normalised matrix in the Aw step.

When CR is high: locate contradictory pairwise entries, ask for revised judgments, and recompute. A mathematical ranking from inconsistent judgments is not a defensible recommendation.

W5/6 • LP then what-if

WORKED

Max z=40x+30y
s.t. 2x+y≤40; x+2y≤50; x,y≥0

(0,25);750

Both resource boundaries bind at the best corner (10,20).

Intersection: y=40-2x. Substitute into x+2y=50: x+80-4x=50 → x=10, y=20. Corners give z: 0, 800, 750, 1000. Check: 2(10)+20=40; 10+2(20)=50.

COEFFICIENT SCENARIO
x coefficient 40; allowable increase 10, decrease 5 → range [35,50]. New coefficient 46 is inside, so x=10,y=20 remain optimal.

znew=46(10)+30(20)=460+600=1060

RHS SCENARIO
Packaging RHS 80; shadow price 6; allowable increase 12, decrease 20 → range [60,92]. Nine extra units give new RHS 89, inside range.

ΔRHS=+9
in range

×

shadow
price=6

=

Δz=54
z=1054

RHS sensitivity gives the objective effect, not the new variable values.

Keep scenarios separate: coefficient change → 1060; RHS change → 1054. They are one-at-a-time conclusions.

LP answer audit

W5–W7

STAGE	VISIBLE EVIDENCE
Variables	Meaning, unit, period; non-negativity/integrity
Objective	Max/min direction; coefficient units
Constraints	One business sentence each; correct ≤/≥/≥
Graph	Half-planes, common feasible region, all vertices
Solution	Variable values + objective + binding/slack

Linearity: each term is a fixed coefficient times one variable. No variable products, powers or nonlinear functions. A relative rule remains linear when written, for example, x≥.30(x + y).

Feasibility: substitute into every constraint/domain. Optimality still needs all feasible corners or a valid solve.

Application transfer: inventory links periods by carryover; portfolio decisions send cash to maturity nodes; media models preserve budget and mix. Draw the conserved flow before indexed balances.

Method chooser

EXAM ROUTING

IF THE STEM ASKS...	FIRST VISIBLE LINE
"Without probabilities"	Profit/cost + named criterion
"Draw/evaluate a tree"	Node legend + probabilities
"After report R"	Bayes table headings
"Worth of information"	No-info baseline
"Several criteria"	Scoring or pairwise AHP?
"Formulate"	Variables with units/time
"Solve graphically"	Boundaries + feasible corners
"What if?" after Solver	Coefficient, RHS or structure?

What changes?

payoff
prob.

objective
coeff.

constraint
RHS

recalculate optimality feasibility

Classification determines the rule, report field and what remains invariant.

Error clinic

ALL WEEKS

WRONG MOVE	REPAIR
Cost treated as profit	Write direction before max/min
Regret across rows	Benchmark within each state
EV reported as certain	Add risk-profile endpoint
P(R S) called posterior	Joint → marginal → divide
High CR ignored	Revisit judgments
Variable lacks unit/time	Rewrite definition
Feasible called optimal	Compare all corners / solve
Shadow price extrapolated	Test RHS range first
Share written as x≥.30	x≥.30(x + y)

RECOMMENDATION STEM
"Using [method], choose [action/plan] because [computed comparison]. This conclusion assumes [probabilities/linearity/range]; the main limitation or risk is [specific feature]."

open + prod. = demand + end.

period t

ending li

→

t+1

carryover

Application models conserve product, cash or budget through the correct time node.

LAST 30 SECONDS Units? Probabilities sum to one? Signs/directions? Range tested? Decision and objective both stated? Limitation named?

Fast definitions

RECALL

Terminal payoff is the full path consequence. Posterior is a state probability after a report. Priority vector is derived AHP weights summing to one. Feasible region satisfies all restrictions. Extreme point is a feasible vertex.