ECON20005 Competition and Strategy

THE UNIVERSITY OF MELBOURNE · ECONOMICS · UNDERGRADUATE · SEMESTER 2, 2026 · EXAM REVISION SHEET

Full guide + ask Sia about ECON20005

SIDE 1/2 · FINAL PRIORITIES · REPRESENT → SOLVE → DEVIATE → INTERPRET · EXAM REVISION SHEET · v2 · 2026-10-25

1 · Exam Map

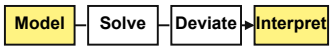
2026 SUBJECT GUIDE

Q 10 · A1 10 · A2 10 · A3 10 · L 5 · T 5 · FINAL EXAMINATION 50

ASSESSMENT	WT	PUBLISHED FORMAT
Weekly quizzes	10%	Weekly LMS quizzes
Assignment 1	10%	Individual assignment
Assignment 2	10%	Individual assignment
Assignment 3	10%	Individual assignment
Lecture participation and activities	5%	During lectures
Tutorial participation	5%	During tutorials
Final examination	**50%**	Pass condition applies

Permitted materials: not confirmed for this offering in the course materials we hold — check the exam instructions on the LMS.

The current Subject Guide states **15 minutes reading time**, then **two hours writing time**, and coverage of all subject topics. Students must pass the end-of-semester examination to pass the subject. [course.json]



players · strategies · timing · information
payoffs → matching solution concept
one-player change → stability + boundary

Answer route distilled from the guide's study strategy. [C1–C8]

1b · Solution-Concept Chooser

TOPIC MAPS

IF THE TASK GIVES…	USE	DECISIVE CHECK
Observed later move	Game tree + backward induction	Continuation optimum
Unobserved choices	Normal form	Best responses
All rival actions	Dominance	Cell-by-cell inequality
Quantity continuum	Reaction functions	Intersection feasible
Randomisation	Indifference	Probabilities in [0,1]

EXAM TIP *A polished calculation cannot repair a misclassified game. State timing and observability before selecting the method.*

1c · Answer Ledger

ALL CHAPTERS

LINE	WRITE	CHECK
1 Represent	Players, complete strategies, timing, information, payoffs	No missing contingency?

2 · Game Anatomy

C1

★ *Player*: decision-maker whose outcome depends on its choice and others' choices. *Strategy*: complete contingent plan at every relevant decision point. *Payoff*: numerical ranking or value assigned to an outcome under the stated representation.

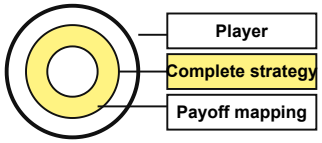
PAYOFF MAPPING

$u_i(s_i, s_{-i})$

Player i's payoff depends on its strategy and all other players' strategy profile.

WRITE FIRST	WHAT MUST BE COMPLETE	FAILURE
Players N	Every decision-maker	Missing strategic actor
Strategy sets S_i	Every contingent action	Action mistaken for strategy
Payoffs u_i	One value per player/outcome	Preference not represented
Timing/info	Who knows what, when	Wrong game form

An action at one node is not automatically a complete strategy. Payoff numbers encode preferences, not money, unless the problem says otherwise.



Redrawn from the C1 source figure: define the game before equilibrium.

2b · Rules, Timing, Information

C2

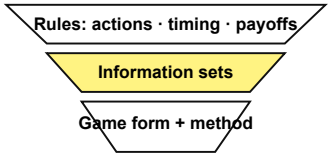
NORMAL-FORM GAME

$G = (N, (S_i)_{i \in N}, (u_i)_{i \in N})$

Rules of the Game specify players, actions, timing, information and payoff consequences. An *Information Set* groups decision nodes a player cannot distinguish. *Common Knowledge* means everyone knows the information, knows others know it, and treats that knowledge as recursively shared.

OBSERVATION	STRATEGIC CLASSIFICATION
Later player observes earlier choice	Sequential reasoning can apply
Later player cannot observe it	Calendar order alone is insufficient
Nodes linked in one information set	Same action must be chosen across them

BOUNDARY *Physical order does not create a strategic first move when later players cannot observe the earlier choice.*



Redrawn from the C2 funnel: information determines the representation.

3 · Sequential Game Trees

C3

★ *Game Tree*: branching moves, information and outcomes. *Decision Node*: a named player chooses among available actions. *Terminal Payoff*: payoff vector attached to a completed path.

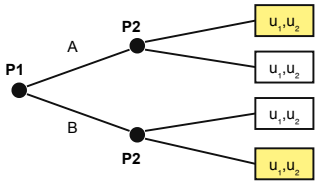
TERMINAL CONTINUATION VALUE

$V_i(h) = u_i(z(h))$

At a terminal history h, continuation value equals the payoff of resulting outcome z.

TREE AUDIT	QUESTION TO ASK
Root	Who moves first strategically?
Every node	Whose choice; what actions?
Information	Which histories are distinguishable?
Every branch	Is every feasible response shown?
Every terminal	Payoff for each player, in order?
Strategies	Complete plan, including off path?

A missing feasible branch changes the game being solved. Every complete path needs a payoff for every player.



Redrawn from the C3 source flow: nodes → branches → every terminal payoff.

3b · Strategy vs Path

C1 + C3

OBJECT	CONTAINS	DO NOT CONFUSE WITH
Action	Choice at one node	Complete strategy
Strategy	Action at every relevant node	Realised path only
Outcome	Terminal history + payoffs	Equilibrium proof

3c · Scenario → Tree

C3 METHOD

SCENARIO PHRASE	TREE OPERATION
"Player 1 chooses…"	Create a named decision node and one branch per feasible action.

4 · Backward Induction

C4

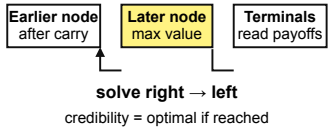
★ *Backward Induction* begins at later decision nodes and replaces each continuation with the choosing player's preferred feasible action. A *Credible Threat* remains optimal if its decision point is reached. A *Subgame* begins at a valid decision node, contains all successors and does not cut an information set.

CHOICE AT HISTORY H

$a_i^*(h) \in \arg\max_{a_i \in A_i(h)} V_i(h, a_i)$

1. Start at each final decision node.
2. Compare that mover's continuation payoffs.
3. Mark an optimal feasible action; carry its value back.
4. Repeat until reaching the initial node.
5. Report the full strategy profile and realised path.
6. Test any stated threat inside its continuation game.

A threat is not credible merely because it changes an earlier player's choice. It must be optimal when the threatened node is actually reached.



Redrawn from C4: choose later continuations before earlier moves.

4b · Credibility Audit

C4 FAQ

CLAIM	TEST	VERDICT
"If you enter, I punish."	At post-entry node, compare punisher's payoffs.	Credible only if punish is optimal.
Outcome deters entry	Does deterrence rely on empty threat?	Do not accept unreached claim.
Proposed subgame	Starts at singleton node; no cut information set?	Only then solve separately.

EXAM TIP *Write the later player's comparison beside the branch it eliminates. The first unsupported pruning is the first lost mark.*

4c · Complete Sequential Answer

C3–C4

PART	MARKER-VISIBLE STATEMENT
Later choice	"At history h, player i prefers a because $V_i(h,a)$ is maximal."
Carry-back	Replace that continuation by its payoff vector, then compare earlier branches.
Strategy	State choices at every relevant node, including unreached ones.
Path	Separately state the realised history and terminal payoff.
Credibility	Name the threatened node and the threatening player's preferred continuation there.

5 · Simultaneous Games + Dominance

C5

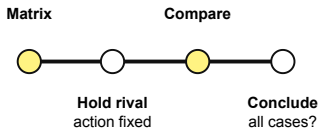
★ *Payoff Matrix*: each action profile with each player's payoff. A *Dominant Strategy* beats each alternative for every rival strategy. A *Dominated Strategy* is always worse than another available strategy.

STRICT DOMINANCE

$u_i(s_i, s_{-i}) > u_i(s'_i, s_{-i})$ for every s_{-i}

PROCEDURE	HOLD FIXED	COMPARE
Row player	Each column in turn	First payoff across rows
Column player	Each row in turn	Second payoff across columns
Strict dominance	All rival actions	> in every comparison
Elimination	Remaining game	Repeat only after valid removal

Dominance is unilateral, not a joint-payoff test. A dominant-strategy outcome need not maximise total payoff.



Redrawn from C5: dominance requires the same comparison in every rival case.

5b · Best Responses + Nash

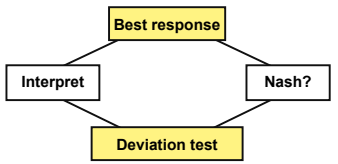
C6

Best Response maximises a player's payoff given others' strategies. *Nash Equilibrium* makes every strategy a best response to the others. A *Unilateral Deviation* changes one player's strategy while all others stay fixed.

NASH CONDITION

$u_i(s_i^*, s_{-i}^*) \geq u_i(s_i, s_{-i}^*)$ for every s_i and every player i

TO FIND / TEST	ACTION
Best responses	For each rival choice, mark own payoff maxima; keep ties.
Candidate Nash	Require every player's mark in same cell/profile.



Redrawn from C6: a candidate survives only all unilateral deviations.

6 · Continuous Strategies

C7

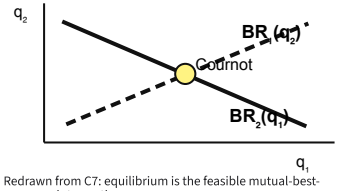
★ *Continuous Strategy*: numerical choice from a range. A *Reaction Function* maps rivals' choices to the player's payoff-maximising continuous action. *Cournot Equilibrium*: quantity-setting equilibrium where each firm's output is a best response to rivals' outputs.

REACTION FUNCTION

$q_i = BR_i(q_j) = \arg\max_{q_i \geq 0} \pi_i(q_i, q_j)$

1. Write the stated payoff/profit function and feasible set.
2. For each player, maximise with the rival's choice held fixed.
3. Derive $BR_i(\cdot)$; retain constraints and boundary candidates.
4. Solve reaction functions simultaneously.
5. Substitute back; verify each is a best response.
6. Interpret comparative movement after a changed parameter.

An intersection counts only if feasible and implied by the stated payoff functions.



Redrawn from C7: equilibrium is the feasible mutual-best-response intersection.

6b · Mixed Strategies

C8

Mixed Strategy: probability distribution over pure strategies. *Expected Payoff*: probability-weighted average payoff. *Indifference Condition*: equal expected payoffs make a player willing to randomise among strategies used with positive probability.

OPPONENT PROBABILITY P

$p\,u_i(a,L) + (1-p)\,u_i(a,R) = p\,u_i(b,L) + (1-p)\,u_i(b,R)$

STEP	CHECK
Choose support	Which pure strategies receive positive probability?
Make opponent indifferent	Use your mixing probability in their payoffs.
Solve both probabilities	Each lies in [0,1].
Check excluded strategies	None earns a strictly higher expected payoff.

TRAP *Solve for the probability that makes the other player indifferent. An infeasible probability or profitable excluded pure strategy invalidates the proposed mixture.*

Forward this to your tutorial group

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Semester 2 examination period, 2–20 November 2026.

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7 · Drill 1 – Expand the Game

C1 WORKED · 9 MARKS

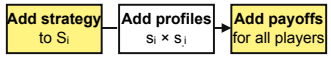
Prompt. Add one feasible strategy for a player and update the payoff representation before attempting equilibrium.

MARKS	ANSWER PATH
3	Fix the case-specific player and its decision role.
2	Rewrite the complete strategy set, not only the newly observed action.
2	Add every new strategy profile and each player's payoff.
2	State the limit: actions at nodes are not automatically complete strategies; payoffs are preferences unless otherwise stated.

Worked answer. First re-list N and every S_i. Adding one strategy enlarges the profile set, so extend $u_i(s_i,s_{-i})$ for *every* new combination. Recheck timing and information: the added option may create extra contingent actions. Only after the representation is complete should dominance, best responses or equilibrium be recomputed.

COMPLETION CHECK

`new Sᵢ → new strategy profiles → new payoff entries → rerun solution concept`



Then solve the changed game
do not recycle the old equilibrium

C1 drill: a changed strategy set forces a changed payoff representation.

7b · Self-Marking Grid

C1 LIMIT

TICK ONLY IF VISIBLE	EVIDENCE
Object	Player and decision identified
Representation	All new profiles/payoffs recorded
Method	Solution concept selected after timing
Stress test	Strongest unilateral alternative checked
Boundary	No money or single-action overclaim

REPAIR *If the conclusion changed before the representation changed, the answer skipped the causal step.*

7c · Transfer Mutations

C1 FAQ

CHANGE	RECOMPUTE FIRST	THEN ASK
Add a player	N, every strategy profile, every payoff vector	Do old responses survive?

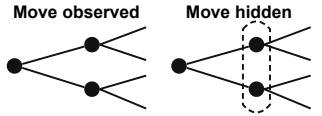
8 · Drill 2 – Remove Observation

C2 WORKED · 11 MARKS

Prompt. Keep calendar order fixed, remove observation of the first action and reclassify strategic timing.

MARKS	ANSWER PATH
3	Restate players, actions and physical order.
3	Join indistinguishable later nodes in an information set; the later choice cannot condition on the hidden action.
3	Translate to the appropriate strategic representation and solve with the information restriction.
2	State that physical order alone does not create a strategic first move.

Worked answer. Removing observation changes the information structure while leaving the calendar unchanged. The later player's nodes are now indistinguishable, so its strategy must prescribe the same feasible action across that information set. A response that conditions on the unseen first action is inadmissible. Rebuild the strategy sets, then apply simultaneous-game best-response reasoning if the choices are strategically simultaneous.



Can condition on observed history

One choice rule across information set

Adapted from C2/C3: observation, not the clock, creates strategic sequence.

8b · If You See X → Do Y

C2 DECISION RULE

YOU SEE	DO	DO NOT
Dashed information set	Use one action rule across linked nodes	Condition on unknown history
Observed earlier move	Draw separate later nodes and solve continuations	Jump straight to matrix
Calendar order only	Ask what is observed	Assume commitment advantage
Common knowledge claim	Check recursive shared knowledge	Reduce to "both know"

8c · Knowledge Layers

C2 GLOSSARY

STATEMENT	WHAT IT ESTABLISHES
Player i knows fact x	Individual information only.
Both know x	Shared first-order knowledge; recursion not yet shown.
Each knows that each knows x, recursively	Common knowledge as defined in the guide.

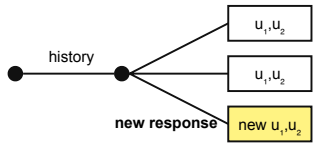
9 · Drill 3 – Edit a Tree

C3 WORKED · 13 MARKS

Prompt. Insert a new response at the second decision node and redraw every affected terminal payoff.

MARKS	ANSWER PATH
4	Identify the exact decision node and mover.
3	Add the response branch and all successors.
3	Attach a complete payoff vector to every new terminal history.
3	State that a missing feasible branch changes the game.

Worked answer. Preserve the original histories, then add the feasible response only where it is available. Extend the strategy of the mover to cover that node and assign payoffs to every completed new path. Because the continuation menu changed, the earlier optimal move may change; do not carry the old solution forward.



C3 drill: new branch → new strategy contingency → new terminal payoff.

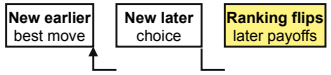
9b · Reverse a Later Ranking

C4 WORKED · 15 MARKS

Prompt. Reverse the later player's payoff ranking and recompute the earlier player's best move.

MARKS	ANSWER PATH
4	Locate every affected continuation.
4	At each later node, select the now-preferred feasible action.
4	Carry changed continuation values back and re-optimise earlier.
3	Retest credibility; state why the old threat survives or fails.

Worked answer. Backward induction is recomputed from the changed later comparison. The new optimal continuation replaces the old one; its value is then carried to the earlier node. Any claimed threat is credible only if the changed payoff ranking still makes it optimal after the node is reached.



recompute right → left

C4 drill: changed continuation values propagate back to the root.

10 · Drill 4 – Matrix Shock

C5 + C6 WORKED

A · DOMINANCE CHANGES · 7 MARKS

Prompt. Raise one cell payoff so a previously dominated strategy becomes viable; repeat the comparisons.

MARKS	ANSWER PATH
2	Rewrite the changed cell with payoff order explicit.
2	Hold each rival action fixed; redo own payoff comparisons.
2	Withdraw dominance only if the all-cases inequality fails.
1	Do not infer joint-payoff maximisation.

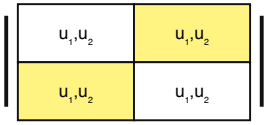
Worked answer. One changed cell can break a universal dominance statement. Recompare the candidate strategy against each alternative for every rival action; if any required inequality reverses or ceases to hold, the prior elimination is no longer justified. Restore the strategy before any later elimination round.

B · CANDIDATE NASH CHANGES · 9 MARKS

Prompt. Change one player's payoff in a candidate equilibrium and retest every unilateral deviation.

MARKS	ANSWER PATH
3	Recompute that player's best response at the affected rival profile.
2	Test whether the candidate still has mutual best responses.
2	Check every one-player deviation with others fixed.
2	Conclude stability only; no fairness, efficiency or uniqueness claim.

Hold rival action fixed



dominance: all cases · Nash: all players
changed cell → redo marks and deviations

Adapted from C5/C6: a local payoff change can overturn a global claim.

10b · Judgement Cards

C5–C6 LIMITS

IF YOU SEE…	WRITE IMMEDIATELY
"Dominant"	For every rival strategy…
"Best response"	Given s_{-i}…
"Nash?"	No profitable unilateral deviation…
Tied payoff	Keep every maximising response.
Cooperative-looking cell	Check stability; appearance is not proof.

11 · Drill 5 – Continuous + Mixed

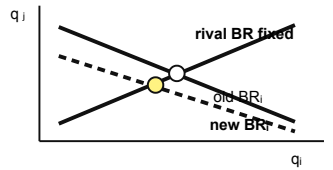
C7 + C8 WORKED

A · INCREASE ONE FIRM'S MARGINAL COST · 11 MARKS

Prompt. Derive how both equilibrium quantities adjust.

MARKS	ANSWER PATH
3	Insert the changed cost into that firm's stated profit function.
3	Re-derive its reaction function, holding rival quantity fixed.
3	Intersect the changed reaction with the rival's reaction.
2	Verify feasibility and that both quantities are mutual best responses.

Worked answer. Change only the affected profit term, then recompute the corresponding $BR_i(q_j)$. Solve the reaction system again; do not move both curves by assumption. The answer is the new feasible intersection plus a verbal comparison with the original equilibrium, conditional on the stated payoff functions.



C7 drill: change the stated function, re-derive, then re-intersect.

B · CHANGE ONE MIXED-GAME PAYOFF · 13 MARKS

Prompt. Recompute the probability that preserves indifference.

MARKS	ANSWER PATH
4	State the support and which opponent probability is unknown.
3	Rewrite both supported expected payoffs using the changed value.
3	Set them equal and solve for the opponent's mixing probability.
3	Check [0,1] and every excluded pure strategy.

$EU_i(a \mid p)$ $EU_i(b \mid p)$

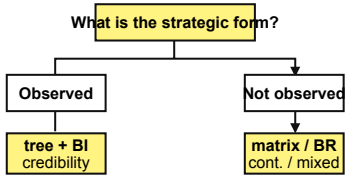
set equal → solve p

C8 drill: the opponent's p balances your supported pure strategies.

12 · Classic Traps

C1–C8 LIMITS

TRAP	FAST CORRECTION
Action = strategy	Write the complete contingent plan.
Payoff = money	Treat as preference ranking unless stated.
Calendar order = sequential	Ask whether the later move observes earlier.
Missing branch ignored	Redraw the game and all affected payoffs.
Threat accepted from words	Optimise at the threatened continuation.
Dominance from one column	Compare every rival strategy.
Joint-best cell = Nash	Test unilateral deviations.
Nash = efficient/unique	State only stability unless separately proved.
Reaction lines merely cross	Check derivation and feasible set.
Own p makes own indifference	Use opponent's p in your expected payoffs.
p outside [0,1] accepted	Reject support or revisit algebra.
Excluded pure strategy omitted	Check it earns no higher payoff.



New recall figure: classify information first, then choose the solver.

12b · Fast Recall Table

GLOSSARY

TERM	RECITE IN ONE LINE
Subgame	Valid node + all successors; no cut information set.
Best response	Own payoff maximiser given others.
Nash	Every strategy is a best response.
Reaction function	Rival choice → own optimal continuous action.
Indifference	Supported pure strategies have equal expected payoff.

13 · Exam-Morning Plan

GUIDE STRATEGY

1. Recite the eight formula boxes and the boundary beside each.
2. Redraw one tree, one matrix, one reaction graph and one indifference equation from memory.
3. For each miss, repair the **first unsupported move**: representation, method, comparison or interpretation.
4. Do one changed-payoff version and state exactly what conclusion reverses.

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