ECON3111: Behavioural Economics
Introduction to Behavioural Economics: Foundations and Rational Choice under Certainty

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Newcastle Business School | University of Newcastle, Australia | Integrated Learning Session

CLO1, CLO3

What this week is for

- Establish the **benchmark** model: rational choice under certainty.
- Learn the **language** of modern choice theory: preferences, axioms, utility.
- See why behavioural economics emerged: systematic **gaps** between benchmark predictions and observed choices.

Course learning outcomes supported this week

- **CLO1:** Identify and explain standard and behavioural approaches.
- **CLO2:** Apply theory to evaluate and critically analyse economic problems.
- **CLO3:** Summarise core insights (this week: rationality as a benchmark).
- **CLO4:** Use formal notation and analytic tools (relations, axioms, utility, optimisation).

CLO1, CLO2, CLO3, CLO4

Learning objectives

By the end of this session, you should be able to:

1. Distinguish **descriptive** from **normative** claims about decision-making.
2. Explain the standard (neoclassical) benchmark: rational choice under certainty.
3. Define preferences as a **relation** on a set of alternatives $\mathcal{U}$ and use the symbols $\succeq$, $\succ$, and $\sim$ correctly.
4. State and interpret the key axioms of rational preferences under certainty: **completeness** and **transitivity**.
5. Construct and interpret a **utility representation** of an ordering and explain what utility means in economics.
6. Solve simple **choice** problems under certainty (discrete menus and budget sets).
7. Explain why behavioural economics studies systematic deviations from the benchmark and how evidence is produced.

CLO1, CLO2, CLO4

Roadmap for the session

1. Motivation: why theories of choice matter
2. What behavioural economics is (and is not)
3. Behavioural economics: origins, purpose, and scope
4. Methods I: evidence and identification (first principles)
5. Rational choice under certainty:
   - Preferences as relations
   - Axioms: completeness and transitivity
   - Indifference and strict preference
   - Utility as a representation
   - Choice from menus and budget sets
6. Behavioural critique under certainty (preview of the course)
7. Integrated activities, answers, exam-style practice

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Motivation: economics is largely about choices

Many economic questions can be re-written as choice questions:

- Consumers: which bundle to buy given prices and income?
- Firms: which technology and output level to choose? which price to set?
- Workers: which job offer to accept? how much to save?
- Governments: which policy package to implement? how to design incentives?

Core idea: to predict outcomes (demand, prices, take-up, compliance), we need a theory of how people choose.

CLO1, CLO2

Why a benchmark matters: the benchmark works well - but not always

A benchmark (standard) model is useful because it:

- provides a clear starting point for explanation and prediction;
- generates disciplined comparative statics (how choices change when constraints change);
- gives precise meaning to **consistency** in choice behaviour.

But we also see persistent puzzles:

- People delay beneficial actions (saving, preventive health).
- People sometimes struggle with consistency, attention, and complexity.

Behavioural economics begins with the benchmark, tests it, then refines it where it fails.

CLO1, CLO2

What behavioural economics is

Behavioural economics studies choice/decision-making under scarcity while retaining the core economic framework, but extends standard models by incorporating psychologically realistic features when traditional assumptions fail to describe observed behaviour well.

Two core commitments

- Preserve the economic perspective by focusing on incentives, trade-offs, and constraints.
- Strengthen behavioural foundations when standard assumptions provide weak predictions or limited explanatory power.

A practical way to think about it

Start with standard benchmark $\rightarrow$ confront it with data $\rightarrow$ introduce behavioural refinements when needed.

CLO1, CLO2

Descriptive vs normative theories of decision: a core distinction

Descriptive: how people *actually* choose (prediction and explanation).
Normative: how people *should* choose (rationality as a standard for correct decision-making).

Why the distinction matters

- A model can be descriptively strong but normatively weak.
- A model can be normatively attractive but descriptively inaccurate.
- Behavioural evidence is often descriptive; policy arguments often invoke normative standards.

CLO1, CLO2

Integrated activity A: descriptive or normative?

Classify each as **descriptive** (D) or **normative** (N).

1. On average, households save less than 10% of their income for retirement.
2. Households do not save as much for retirement as they should.
3. Many people regret not saving more for retirement.
4. Consumers are sometimes willing to pay more to avoid complicated forms.

Think–pair–share (2 minutes): justify your classification using the definitions.

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Standard economics as a benchmark: rational choice

A common benchmark assumption is that people:

- have **well-defined preferences** over available alternatives;
- choose the **most preferred** feasible option;
- respond predictably to changes in prices, income, and constraints.

Why a benchmark is valuable:

- It is clear, formal, and often generates sharp predictions.
- It gives a language for what it means to be consistent in choice.
- It provides a starting point for critique and improvement.

CLO1, CLO4

Rationality: a definition, not praise

In everyday language, the word *rational* is often used as a compliment, meaning sensible, smart, or well judged.

In this course, however, **rational choice theory** uses the term in a strictly technical sense:

- It specifies formal properties of preferences and the way choices are made.
- It places no restrictions on what people care about; objectives may be selfish or altruistic, material or moral.

Key point: describing a choice as rational means it is consistent with the assumptions of a model, not that it is wise, ethical, or socially desirable.

CLO1, CLO3

The behavioural critique of the benchmark

Behavioural economics asks:

- Are deviations from the benchmark **large enough** to matter?
- Are deviations **systematic enough** to be predicted?
- Can we build models that fit data better without losing economic discipline?

Common themes (course preview):

- Bounded attention and limited cognitive resources.
- Context dependence: preferences can be constructed or unstable.
- Heuristics: rules of thumb that work well in some environments but fail in others.

CLO1, CLO2

Origins: why behavioural economics emerged (brief)

The standard benchmark model is powerful, but a set of persistent empirical puzzles motivated its refinement:

- systematic departures from internal consistency, such as preference reversals and instability across frames;
- choices that depend on defaults and presentation, indicating context dependence;
- limits to attention and cognitive processing in complex decision environments.

Foundational move: interpret these patterns as **systematic regularities** that require modelling, rather than as random noise to be ignored.

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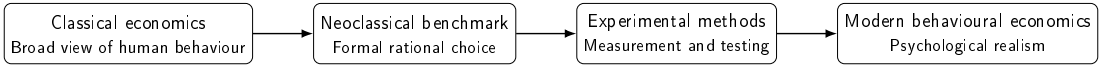
Origins: a short timeline (high level)



Interpretation: behavioural economics does not reject economics; it builds on the standard framework and refines its behavioural foundations when evidence requires it.

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Methods I: where behavioural evidence comes from

Behavioural economics draws on several complementary sources of evidence, each with distinct strengths:

- **Laboratory experiments:** highly controlled settings with real incentives, allowing clean tests of specific mechanisms (for example, loss aversion or social preferences).
- **Field data:** naturally occurring real-world behaviour, offering high realism, though causal interpretation is often complicated by confounding factors.
- **Field experiments:** randomised interventions in real settings, such as default changes or information nudges, designed to estimate policy-relevant causal effects.
- **Stated preference / surveys:** quick measurement of beliefs, attitudes, and intended behaviour; responses may differ from incentivised choices.
- **Process measures:** response times, attention, and information search, which shed light on how decisions are formed, not just what is chosen.

Triangulation: the most persuasive findings show consistent patterns across multiple methods.

CLO2, CLO4

Identification: correlation vs causation (first principles)

An observed relationship between two variables does not, by itself, establish a causal effect.

Key threats to causal inference

- **Confounding:** an unobserved factor influences both the treatment and the outcome.
- **Selection:** individuals choose into treatments or options in a non-random way or participants self-select into options.
- **Reverse causality:** the outcome influences the explanatory variable rather than the other way around.

Why experiments matter: random assignment breaks the systematic link between treatment and confounders, enabling causal interpretation.

CLO2, CLO4

A minimal experimental design (illustrative)

Suppose we want to test whether setting a default increases enrolment in a programme.

- Randomly assign individuals to one of two groups:
  - Control: enrolment requires actively opting in.
  - Treatment: enrolment is automatic (the default) unless the individual opts out.
- Measure and compare enrolment rates across the two groups.

Interpretation: with random assignment, the difference in enrolment rates identifies/estimates the causal effect of the default, holding other factors constant *on average*.

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Hypothetical choices: strengths and limits

Strengths

- Fast and low-cost to implement.
- Allow study of rare, future, or ethically sensitive scenarios.
- Useful for eliciting beliefs, expectations, and stated attitudes.

Limits

- Behaviour may differ when choices carry real consequences.
- Responses can be influenced by social desirability or survey framing.

Practical lesson: hypothetical data are informative, but should be interpreted cautiously.

CLO2, CLO4

Laboratory experiments: controlled tests with incentives

Defining features

- Participants make real decisions, often with real monetary pay-offs.
- The environment is controlled: the researcher sets information, options, and rules.

What labs are good for

- Clean tests of theory by isolating one mechanism at a time.
- Systematic variation: change a single feature and observe behavioural responses.

What labs can struggle with

- External validity: simplified lab choices may not fully capture complex real-world decisions.

CLO2, CLO4

Field data and field experiments

Field (observational) data

- Recorded in real environments such as markets, workplaces, or health decisions.
- High realism, but causal inference is often limited by confounding and selection.

Field experiments

- Use random assignment in natural settings.
- Enable stronger causal conclusions and are often designed with policy application in mind.

Key takeaway: field evidence is crucial for assessing whether behavioural effects matter at scale.

CLO2, CLO4

Process measures, neuroscience, and robustness

Process measures focus on how decisions are made, not only what is chosen:

- Response times, eye tracking, information acquisition, mouse movements/tracking.
- Physiological indicators such as arousal or stress, interpreted carefully and contextually.

A note on robustness

- Findings are more credible when they replicate across methods, samples, and settings.
- Replication and transparent reporting are central to credible behavioural science.

CLO2, CLO4

Transition: why begin with choice under certainty?

We start with the simplest possible decision environment:

- **Certainty:** each option leads to a known and definite outcome, with no uncertainty or probabilities involved.
- The benchmark model in this setting is mathematically clean and introduces the core notation and logic used throughout the course.
- More complex topics, such as choice under risk, intertemporal choice, and social preferences, are natural extensions of this foundation.

Choice under certainty: definition and examples

Choice under certainty refers to situations in which the decision-maker knows exactly which outcome will result from each available action.

Examples include:

- choosing tea or coffee at a café, where the outcome of each option is known in advance;
- selecting one of two commuting routes when the travel time and cost are known;
- purchasing a specific bundle of groceries at clearly posted prices.

Not included at this stage are decisions involving lotteries, uncertain outcomes, or strategic interaction with others, which are introduced in later weeks.

CLO1, CLO3

Alternatives and bundles

Let $\mathcal{U}$ be the **set of alternatives** (also called the **universe**):

$$\mathcal{U} = \{x, y, z, \dots\}$$

Each element of $\mathcal{U}$ is an option the decision-maker could choose.

In consumer settings, an alternative is often a **bundle** of goods:

$$(x_1, x_2) \quad \text{or} \quad (x_1, x_2, \dots, x_n)$$

where $x_i \geq 0$ is the quantity of good i.

Example: $(3, 2)$ could mean 3 apples and 2 bananas.

CLO4

Preferences are relations

In economics, preferences are described using a **relation** defined over a set of alternatives $\mathcal{U}$.

A **relation** is simply a way of comparing pairs of options. Formally, it is a set of ordered pairs:

$$R \subseteq \mathcal{U} \times \mathcal{U}.$$

If $(x, y) \in R$, we write $x\, R\, y$, meaning that option x is related to option y in some specified way.

A **preference relation** uses this idea to represent how a decision-maker compares options:

$$x \succeq y \quad \text{means "}x\text{ is at least as good as }y\text{"}.$$

This is called a **weak preference** because it allows for both strict preference and indifference.

Example: suppose $\mathcal{U} = \{\text{tea}, \text{coffee}\}$. Writing

$$\text{coffee} \succeq \text{tea}$$

means the person likes coffee at least as much as tea. They may strictly prefer coffee, or they may be indifferent between the two.

Using relations allows us to study choice in a precise and consistent way.

The universe $\mathcal{U}$ (set of alternatives)

To analyse preferences precisely, we must first specify *what* the decision-maker is choosing between. This set of possible options is called the **universe of alternatives**, denoted by $\mathcal{U}$.

Examples of different universes include:

- $\mathcal{U} = \{\text{tea}, \text{coffee}\}$, where the choice is between two drinks.
- $\mathcal{U} = \{(x, y) : x \geq 0,\ y \geq 0\}$, where x represents apples and y represents bananas, and each option is a bundle of goods.
- $\mathcal{U} = \{\text{Policy A}, \text{Policy B}, \text{Opt-out}\}$, where the alternatives are policy options rather than consumption goods.

Key point: the properties of a preference relation are defined *relative to the universe*. Changing $\mathcal{U}$ can therefore change whether a relation satisfies certain theoretical assumptions.

CLO4

Weak preference $\succeq$: interpretation

$$x \succeq y \quad \Longleftrightarrow \quad \text{the decision-maker ranks } x \text{ at least as high as } y.$$

This expression captures how options are ordered in the decision-maker's mind.

Key points:

- **Ties are allowed:** it is possible that both $x \succeq y$ and $y \succeq x$ hold. In this case, the individual is *indifferent* between x and y.
- **Ranking, not feelings:** $\succeq$ describes an ordering of options, not how happy, emotional, or wealthy someone feels when choosing them.

Example: if a student is indifferent between taking the bus or the train to campus, then both

$$\text{bus} \succeq \text{train} \quad \text{and} \quad \text{train} \succeq \text{bus}$$

are true.

Axiom 1: completeness

Completeness requires that every pair of alternatives can be compared:

$$\forall x, y \in \mathcal{U}, \quad x \succeq y \text{ or } y \succeq x \text{ (or both).}$$

Intuition:

- For any two options x and y, the decision-maker can always state whether x is at least as good as y, or y is at least as good as x.
- Responses such as "I cannot compare these two options" are not allowed under completeness.

Example: suppose a student compares studying at home (x) versus studying in the library (y). Completeness means the student can say either $x \succeq y$, or $y \succeq x$, or that they are equally good.

Why it matters: completeness guarantees that it is possible to construct a full ranking of all alternatives, allowing for ties.

Axiom 2: transitivity

Transitivity requires that preferences are internally consistent across comparisons:

$$\forall x, y, z \in \mathcal{U}, \quad (x \succeq y \text{ and } y \succeq z) \Rightarrow x \succeq z.$$

Intuition:

- If a decision-maker ranks x at least as high as y, and ranks y at least as high as z, then they must also rank x at least as high as z.
- Transitivity rules out preference cycles (for example, preferring x to y, y to z, but z to x), which would make the idea of a "best" option unstable.

Example: if a person prefers coffee to tea and tea to water, transitivity implies they must prefer coffee to water.

CLO4

Axiomatic theories: why we care

An **axiomatic** theory builds a model of behaviour by starting from clearly stated components:

- **Axioms:** basic assumptions about behaviour, such as completeness and transitivity.
- **Definitions:** precise concepts derived from the axioms, such as strict preference $\succ$ and indifference $\sim$.
- **Implications:** logical results that follow from the axioms and definitions.

Why this approach is useful:

- It makes all assumptions transparent/explicit rather than implicit.
- It tells us exactly what must be true if the assumptions hold.
- When observed behaviour contradicts the model, it identifies precisely which assumption is violated.

Example: if observed choices contain cycles, the axiomatic framework points directly to a failure of transitivity rather than to a vague modelling error.

CLO1, CLO4

What completeness implies: reflexivity

If preferences satisfy completeness, then for any option $x \in \mathcal{U}$,

$$x \succeq x.$$

Reason:

- Completeness requires that every pair of alternatives can be compared.
- This applies not only to distinct options (x, y), but also to the case where $y = x$.
- Hence, at least one of $x \succeq x$ or $x \succeq x$ must hold, which is simply the same statement.

Interpretation: every option is ranked at least as good as itself.

Example: a cup of coffee is at least as good as the same cup of coffee. Reflexivity does not say the option is good or bad, only that self-comparison is well defined.

CLO4

What transitivity rules out: cycles

A **strict preference cycle** occurs when preferences form a loop:

$$x \succ y, \quad y \succ z, \quad z \succ x.$$

If such a cycle exists, the idea of a "best" option becomes meaningless:

- Starting from x, moving to y is justified because y is strictly better.
- From y, moving to z is again justified because z is strictly better.
- From z, moving back to x is also justified because x is strictly better.

Example: suppose a student prefers coffee to tea, tea to water, and water to coffee. No option can be identified as best, because there is always another option that is preferred.

Key point: transitivity rules out these cycles, ensuring that preferences are internally consistent and that a best option can exist.

CLO4

Integrated activity B: identify violations

For each scenario below, determine whether the stated preferences violate **completeness**, **transitivity**, **both**, or **neither**.

Scenario 1 (incomparability): a student says, "I cannot compare internship A and internship B; they are too different."

Scenario 2 (cycle): a student says, "I prefer A to B, B to C, and C to A."

Scenario 3 (consistent ranking): a student says, "I rank A above B above C, and B and C are not tied."

Guidance:

- Ask whether all pairs of options can be compared (completeness).
- Ask whether the rankings are logically consistent across comparisons (transitivity).

Quick check (2 minutes): write down your answer for each scenario and give a one-sentence justification.

CLO1, CLO4

Indifference $\sim$: definition

Indifference is defined using weak preference as follows:

$$x \sim y \quad \Longleftrightarrow \quad (x \succeq y) \text{ and } (y \succeq x).$$

Interpretation:

- The decision-maker ranks options x and y as equally good: neither is preferred over the other.
- Indifference is about how options are ranked, not about feelings, emotions, or how strongly someone cares.

Example: if a student is equally happy taking the bus or the train to campus, then both

$$\text{bus} \succeq \text{train} \quad \text{and} \quad \text{train} \succeq \text{bus}$$

hold, so the student is indifferent between the two options.

Strict preference $\succ$: definition

A decision-maker is said to **strictly prefer** option x to option y when x is ranked higher than y, with no tie between them.

Formally, strict preference is defined in terms of weak preference:

$$x \succ y \quad \Longleftrightarrow \quad (x \succeq y) \text{ and } \neg(y \succeq x).$$

Interpretation:

- Option x is ranked above option y; the decision-maker considers x better than y.
- This definition distinguishes strict preference from indifference, where both options are ranked equally.

Example: if a student prefers studying at home to studying in the library, but not the other way around, then

$$\text{home} \succ \text{library}$$

holds.

Basic logical implications you should know

The definitions of strict preference and indifference immediately imply some useful logical relationships.

From the definition of strict preference:

$$x \succ y \;\Rightarrow\; x \succeq y \quad \text{and} \quad x \succ y \;\Rightarrow\; \neg(y \succeq x).$$

This means that if x is strictly preferred to y, then x must be at least as good as y, and y cannot be at least as good as x.

From the definition of indifference:

$$x \sim y \;\Rightarrow\; x \succeq y \text{ and } y \succeq x.$$

This means that if the decision-maker is indifferent between x and y, then each option is ranked at least as good as the other.

Why this matters: these implications are repeatedly used in formal proofs and in exam questions, so it is important to be comfortable moving between strict preference, indifference, and weak preference.

Worked example 1: check completeness and transitivity

Let $\mathcal{U} = \{A, B, C\}$ and suppose the decision-maker reports:

$$A \succeq B, \quad B \succeq C, \quad A \succeq C, \quad B \succeq A.$$

Step 1 (completeness): check each pair:

- (A, B): both $A \succeq B$ and $B \succeq A$ are given.
- (B, C): $B \succeq C$ is given.
- (A, C): $A \succeq C$ is given.

This is consistent with completeness (no pair is left incomparable).

CLO4

Worked example 1: continue (transitivity and interpretation)

Step 2 (transitivity):

- From $A \succeq B$ and $B \succeq C$, transitivity requires $A \succeq C$ (given) ✓
- From $B \succeq A$ and $A \succeq C$, transitivity requires $B \succeq C$ (not stated, but could still be true).

What can we conclude?

- The data do not *contradict* transitivity.
- We can also infer $A \sim B$ because both $A \succeq B$ and $B \succeq A$ are true.

CLO2, CLO4

Preference ordering: lists (with possible ties)

When the preference relation $\succeq$ satisfies **completeness** and **transitivity**, preferences can be represented as an ordered list, where ties are allowed.

Best
$\uparrow$
Option x
Options y and z (tied)
Option w
$\downarrow$
Worst

How to read this ordering:

- Option x is strictly preferred to both y and z.
- Options y and z are equally ranked, so $y \sim z$.
- Both y and z are strictly preferred to option w.

Key point: this kind of ordering ranks every element in $\mathcal{U}$ from best to worst, while allowing for ties through

Utility: a numerical representation of preferences

A **utility function** is a rule that assigns a number to each possible option:

$$u : \mathcal{U} \to \mathbb{R}.$$

That is, every alternative in the set $\mathcal{U}$ is given a real number.

The purpose of a utility function is not to measure happiness, but to **represent preferences**. It represents the preference relation $\succeq$ if, for all $x, y \in \mathcal{U}$,

$$x \succeq y \iff u(x) \geq u(y).$$

How to interpret this:

- If option x is ranked at least as high as option y, then the utility number assigned to x is at least as large as the number assigned to y.
- If two options are tied in preference, they receive the same utility number.
- Only the ranking of numbers matters, not their absolute size.

Example: if a student prefers coffee to tea and tea to water, one possible utility assignment is

$$u(\text{coffee}) = 3, \quad u(\text{tea}) = 2, \quad u(\text{water}) = 1.$$

Many other number assignments would work equally well, as long as they preserve the same ordering.

Key point: higher utility numbers correspond to more preferred options.

What utility means (and what it does not mean)

In modern economic theory, utility is:

- a numerical **index** of preference ordering or an index that preserves the ranking of options;
- a tool that makes choice problems easier to analyse.

Utility is not automatically:

- happiness,
- pleasure,
- money,
- moral value.

Key point: many different utility functions can represent the same preferences (only the ranking matters).

CLO1, CLO4

Worked example 1: from ranking to utility

Suppose the set of alternatives is

$$\mathcal{U} = \{A, B, C, D\},$$

and the preference ordering is:

$$A \succ B \sim C \succ D.$$

This tells us only the *ranking* of options:

- A is ranked highest.
- B and C are equally ranked.
- D is ranked lowest.

One utility function that represents these preferences is:

Alternative	Utility $u(\cdot)$
A	3
B	2
C	2
D	1

Check: higher-ranked options receive higher numbers, and tied options receive the same number.

Worked example 1 (continued)

Several important points are implicit in this construction.

First: utility numbers are not unique

- The numbers $3, 2, 2, 1$ are just one convenient choice.
- For example, $u(A) = 100$, $u(B) = 5$, $u(C) = 5$, $u(D) = 0$ would represent the same preferences.

Second: only rankings matter

- The differences between numbers (e.g. $3 - 2$ vs. $2 - 1$) have no meaning here.
- Utility in this setting is *ordinal*, not cardinal.

Third: ties must be respected

- Because $B \sim C$, they must receive the same utility.
- Giving different numbers to B and C would contradict the stated preferences.

Takeaway: a utility function is simply a numerical coding of a ranking. Many such codings are possible, as long as they preserve the preference order.

Worked example 2: different utilities can represent the same preferences

Using the utility function $u(\cdot)$ from the previous example, define a new function:

$$v(x) = 10\,u(x) + 7.$$

This new function simply rescales and shifts the original utility numbers.

For any two alternatives x and y,

$$u(x) \geq u(y) \iff 10u(x) + 7 \geq 10u(y) + 7 \iff v(x) \geq v(y).$$

What this shows:

- The ranking of options under $v(\cdot)$ is exactly the same as under $u(\cdot)$.
- No preference information is changed by multiplying by 10 or adding 7.

Concrete example: if $u(A) = 3$ and $u(B) = 2$, then

$$v(A) = 10 \cdot 3 + 7 = 37 \quad \text{and} \quad v(B) = 10 \cdot 2 + 7 = 27,$$

and A is still ranked above B.

Key interpretation: under certainty, utility is *ordinal*. Any strictly increasing transformation of a utility function preserves the preference ordering and therefore represents the same preferences.

Integrated activity C: build a utility representation

Let $\mathcal{U} = \{x, y, z, w\}$ and suppose:

$$x \succ y, \quad y \succ z, \quad z \sim w.$$

- (i) Write the implied ranking from best to worst (include ties).
- (ii) Construct a utility function $u : \mathcal{U} \to \mathbb{R}$ that represents these preferences.
- (iii) Construct a different utility function representing the same preferences.

Hint: only the ordering matters. You can use any numbers that preserve it.

CLO4

From preferences to choice: what is rational choice under certainty?

A person is said to be **rational under certainty** when their observed choices can be explained by stable and consistent preferences.

Formally, this requires two conditions:

1. Preferences $\succeq$ are **complete** and **transitive**, so all feasible options can be ranked without contradiction.
2. Given any feasible set of options, the individual chooses an option that is **most preferred** within that set.

Equivalent statement: a rational decision-maker never chooses an option that is strictly worse than another option that is available.

CLO1, CLO4

Rational choice under certainty (continued): what is implicit

Several assumptions are implicit in this definition.

Choice reflects preferences

- Observed choices are assumed to reveal underlying preferences.
- If a person chooses x when y is available and $y \succ x$, this is a violation of rational choice.

Constraints are respected

- Rationality is always defined *relative to the feasible set*.
- Choosing the best option does not mean choosing the best imaginable option, only the best among what is available.

Multiple best options are allowed

- If several options are tied for best, choosing any of them is consistent with rational choice.
- Rationality does not require deterministic or unique choices when indifference exists.

Key takeaway: rational choice under certainty links consistent preferences to observed choices, without making claims about intelligence, morality, or outcomes.

Menus: feasible sets of options

A **menu** M is the set of options that are actually available to the decision-maker in a given situation:

$$M \subseteq \mathcal{U}.$$

The individual is assumed to choose exactly one option from this menu.

Key idea: a menu represents the decision problem the person actually faces, not all options they could imagine.

CLO4

Menus (continued): constraints and relevance

What determines the menu:

- Prices and income (what can be afforded).
- Availability (what is in stock or offered).
- Rules or institutions (eligibility, regulations).

Important implication:

- Options outside the menu are irrelevant for assessing rationality.
- A person is not irrational for failing to choose an option that is unavailable.

CLO4

Menus (continued): rational choice condition

Rationality under certainty requires:

- If option x is chosen from menu M, then there is no option $y \in M$ such that $y \succ x$.

This condition ensures that the chosen option is among the most preferred options in the menu.

CLO4

Menus (continued): example

Example:

- Menu: $\{\text{coffee}, \text{tea}, \text{water}\}$.
- Preferences: $\text{coffee} \succ \text{tea} \succ \text{water}$.

Implication:

- Choosing coffee or tea is rational.
- Choosing water is not rational, because a strictly preferred option is available.

CLO4

Menus (continued): opt-out and feasibility

Why opt-out options are often included:

- They guarantee that the menu is never empty.
- They ensure the individual can always make a feasible choice.

Examples:

- "Buy nothing" in a purchasing decision.
- "Do not enrol" in a programme choice.

Including an opt-out option simplifies analysis and ensures feasibility in economic models.

CLO4

Budget sets as menus in consumer choice

In consumer choice problems, the menu of feasible options is called the **budget set**.

The budget set describes all consumption bundles a consumer can afford given prices and income.

CLO4

Budget sets (continued): objects in the problem

Consider a consumer choosing between two goods:

- x = quantity of good 1 (e.g. apples),
- y = quantity of good 2 (e.g. bananas),
- p_x = price per unit of good 1,
- p_y = price per unit of good 2,
- m = income (total budget).

Quantities must be non-negative:

$$x \geq 0, \quad y \geq 0.$$

CLO4

Budget sets (continued): definition

The **budget set** is the set of all affordable bundles:

$$B = \{(x, y) \in \mathbb{R}^2_+ : \ p_x x + p_y y \leq m\}.$$

How to read this condition:

- Total spending on goods 1 and 2 cannot exceed income.
- Bundles that cost more than m are not feasible and are not in the menu.

CLO4

Budget sets (continued): intuition and example

Example:

- Apples cost \$2 each ($p_x = 2$),
- Bananas cost \$1 each ($p_y = 1$),
- Income is \$10 ($m = 10$).

Feasible bundles include:

- $(x, y) = (5, 0)$ spending \$10 on apples,
- $(x, y) = (2, 6)$ spending \$10 in total,
- $(x, y) = (0, 10)$ spending \$10 on bananas.

Not feasible:

$$(x, y) = (6, 2) \quad \text{because } 2 \cdot 6 + 1 \cdot 2 = 14 > 10.$$

CLO4

Budget sets (continued): link to rational choice

Key connection to menus:

- The budget set B is the consumer's menu.
- Rational choice means selecting the most preferred bundle within B.
- Bundles outside B are irrelevant for evaluating rationality.

Takeaway: consumer choice problems are a special case of rational choice from a menu, where the menu is determined by prices and income.

CLO4

The budget line: what it represents

The **budget line** is the boundary of the budget set:

$$p_x x + p_y y = m.$$

It shows all combinations of goods x and y that exactly exhaust the consumer's income.

Key point:

- Points *on* the budget line use the entire budget.
- Points *inside* the line are affordable but leave some income unspent.
- Points *outside* the line are not affordable.

CLO4

The budget line (continued): intercepts

The intercepts show the maximum amount of one good that can be consumed if the consumer buys only that good.

x-intercept (all spending on x):

$$x = \frac{m}{p_x} \quad \text{when } y = 0.$$

y-intercept (all spending on y):

$$y = \frac{m}{p_y} \quad \text{when } x = 0.$$

Example:

- Income $m = 10$,
- Price $p_x = 2$, price $p_y = 1$.

Then the intercepts are $x = 5$ and $y = 10$.

The budget line (continued): slope

When the budget line is drawn with x on the horizontal axis and y on the vertical axis, its slope is

$$\frac{dy}{dx} = -\frac{p_x}{p_y}.$$

What the slope means:

- The slope is negative because getting more of one good requires giving up some of the other.
- The magnitude of the slope depends only on prices, not on income.

CLO4

The budget line (continued): economic interpretation

Interpretation of the slope:

- $-\frac{p_x}{p_y}$ is the *market trade-off*.
- It tells us how many units of good y must be given up to obtain one extra unit of good x.

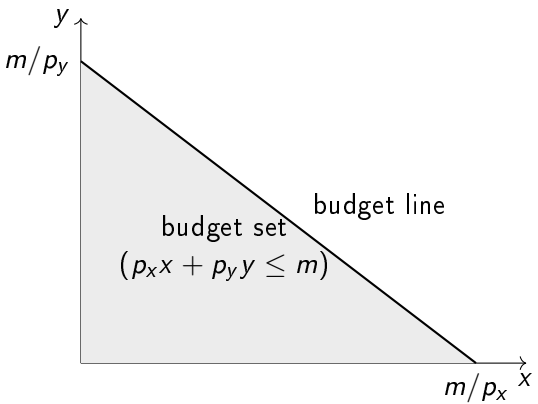
Example:

- If $p_x = 2$ and $p_y = 1$, then the slope is -2.
- This means gaining one more unit of x requires giving up two units of y.

Takeaway: the budget line summarises affordability, while its slope captures the relative prices faced by the consumer.

CLO4

Diagram: budget set and budget line



CLO4

Indifference curves: definition

Suppose a utility function $u(x, y)$ represents preferences over bundles of two goods.

An **indifference curve** for utility level k is the set of all bundles that give exactly that utility:

$$\{(x, y) : u(x, y) = k\}.$$

What this means:

- Every point on the same indifference curve is equally preferred.
- Moving along the curve does not make the decision-maker better or worse off.

CLO4

Indifference curves (continued): interpretation

How to read an indifference curve:

- If two bundles lie on the same curve, the decision-maker is indifferent between them.
- The curve is a visual representation of the preference relation.

More is better assumption:

- If both goods are desirable ("goods"), then bundles with more of both goods are preferred.
- As a result, indifference curves further to the north-east represent higher utility.

Example:

- A bundle with more apples and more bananas lies on a higher indifference curve.

CLO4

Why indifference curves usually slope downward

Assume both goods are **goods**, meaning more of each is weakly better:

$$(x', y') \geq (x, y) \text{ component-wise, with at least one strict } \Rightarrow (x', y') \succ (x, y).$$

This assumption rules out satiation and says the decision-maker prefers more to less.

CLO1, CLO4

Indifference curves (continued): downward slope

Under the "more is better" assumption, indifference curves typically slope **downward**.

Reason:

- If the amount of good x increases, utility rises.
- To keep utility fixed at the same level k, the amount of good y must decrease.

Interpretation:

- The downward slope reflects a trade-off: more of one good requires less of the other to remain equally satisfied.

CLO1, CLO4

When indifference curves may not slope downward

Indifference curves do not always slope downward.

Possible exceptions:

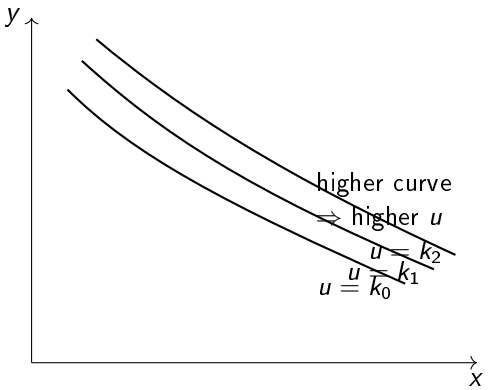
- If one variable is a **bad** (more is worse), such as pollution or effort.
- If preferences are not monotone, for example when too much of a good becomes undesirable.

Key takeaway:

- Downward-sloping indifference curves reflect standard assumptions about preferences.
- Different assumptions about what people like or dislike can change their shape.

CLO1, CLO4

Diagram: indifference curves (downward sloping, typical case)



CLO4

Rational choice on a budget set: core idea

Given a budget set B and well-defined preferences, **rational choice** selects the feasible bundle that lies on the **highest attainable** indifference curve.

What this means:

- The consumer considers only bundles inside or on the budget set.
- Among those feasible bundles, they choose the one that gives the highest utility.

Graphically, this is the indifference curve that just touches the budget set without crossing it.

CLO2, CLO4

Rational choice (continued): interior solutions

When preferences are smooth and strictly convex, the optimal bundle is often an **interior solution**, meaning both goods are consumed in positive amounts.

At such a point, the indifference curve is tangent to the budget line, and the following condition holds:

$$\text{MRS}_{x,y} = \frac{p_x}{p_y}.$$

How to interpret this condition:

- $\text{MRS}_{x,y}$ is the *marginal rate of substitution*: how much of good y the consumer is willing to give up to get one more unit of x, while staying equally satisfied.
- $\frac{p_x}{p_y}$ is the *market trade-off*: how much y must be given up to buy one more unit of x.

At the optimum, the consumer's willingness to trade equals the market trade-off.

CLO2, CLO4

Rational choice (continued): intuition with an example

Example:

- Suppose apples cost \$2 each and bananas cost \$1 each.
- Then $\frac{p_x}{p_y} = 2$.

Interpretation:

- The market requires giving up 2 bananas to get 1 more apple.
- At the optimal bundle, the consumer is willing to give up exactly 2 bananas for 1 apple.

If the consumer were willing to give up more than 2 bananas, they would want more apples. If they were willing to give up less than 2 bananas, they would want fewer apples.

CLO2, CLO4

Rational choice (continued): corner solutions

Not all preferences lead to interior solutions.

Linear preferences:

- Indifference curves are straight lines.
- The marginal rate of substitution is constant.

Implication:

- The highest attainable indifference curve typically touches the budget set at a **corner**.
- The consumer spends all income on one good and none on the other.

Example: if a consumer always values apples twice as much as bananas, they will buy only apples whenever apples are relatively cheap.

CLO2, CLO4

Rational choice on a budget set: takeaway

Summary:

- Rational choice selects the best feasible bundle.
- Interior optima satisfy MRS $= \frac{p_x}{p_y}$.
- Linear preferences often lead to corner solutions.

This framework links preferences, prices, and observed choices in consumer theory.

CLO2, CLO4

Worked example 4: a full numerical choice problem (discrete bundles)

Suppose:

$$m = 12, \quad p_x = 3, \quad p_y = 4$$

and preferences are represented by:

$$u(x, y) = x + 2y,$$

where $x, y \geq 0$ are integers.

Task: choose (x, y) to maximise $u(x, y)$ subject to:

$$3x + 4y \leq 12.$$

CLO2, CLO4

Worked example 4: solve by enumerating feasible bundles

List feasible values of y and the largest affordable x:

y	Budget used ($4y$)	Max x with $3x \leq 12 - 4y$	Utility $u = x + 2y$
0	0	$x = 4$	$4 + 0 = 4$
1	4	$x = 2$	$2 + 2 = 4$
2	8	$x = 1$	$1 + 4 = 5$
3	12	$x = 0$	$0 + 6 = 6$

Conclusion: the optimal bundle is $(x^*, y^*) = (0, 3)$ with utility $u = 6$.

CLO2, CLO4

Behavioural critique under certainty: core idea

Even in simple choice environments with no risk or time trade-offs, observed behaviour can depart from the standard rational-choice benchmark.

These deviations arise not because outcomes are uncertain, but because of how people process information and make decisions.

CLO1, CLO2

Behavioural critique under certainty (continued): main sources

Several mechanisms can generate systematic departures from the benchmark:

- **Limited attention:** individuals may focus on only a subset of attributes (e.g. price but not quality).
- **Context effects:** the way options are presented, or which alternatives are included, can change choices.
- **Complexity:** as the number of options or attributes increases, decision quality can deteriorate.
- **Status quo bias:** individuals may stick with a default option even when better alternatives are available.

CLO1, CLO2

Behavioural critique under certainty (continued): intuition and examples

Illustrative examples:

- A consumer ignores a cheaper but slightly harder-to-find product.
- Adding a third option to a menu changes the choice between the original two.
- Faced with many similar plans, a person selects one at random or sticks with the default.
- An employee remains in a default pension plan despite preferring another option when prompted.

These patterns are systematic, not random mistakes.

CLO1, CLO2

Behavioural critique under certainty: why it matters

Key question for the course:

- When are these behavioural effects large and persistent enough to affect welfare, market outcomes, and policy design?

Answering this question motivates the use of behavioural models and evidence throughout the course.

CLO1, CLO2

A simple certainty example: framing

Sometimes two descriptions refer to exactly the same underlying object or outcome, yet people respond to them differently.

This phenomenon is known as **framing**.

CLO1, CLO2

Framing (continued): equivalent descriptions

Frame 1	Frame 2
"95% fat-free"	"5% fat"
"success rate 90%"	"failure rate 10%"

Key observation:

- Each pair describes the same objective facts.
- Only the wording differs.

CLO1, CLO2

Framing (continued): benchmark prediction vs evidence

Benchmark prediction:

- Under strict rational choice with stable preferences over outcomes, equivalent descriptions should lead to the same choice.
- The decision-maker should care only about the underlying outcome, not how it is described.

Behavioural evidence:

- In practice, people often react more positively to "95% fat-free" than to "5% fat".
- Choices change even though the outcomes do not.

Implication: framing effects violate the benchmark assumption that preferences depend only on outcomes.

CLO1, CLO2

Common misconceptions and pitfalls: overview

Several common misunderstandings arise when learning rational choice and behavioural economics. Clarifying these early helps avoid confusion later in the course.

CLO1, CLO3

Misconception 1: "Rational means selfish"

Claim: Rational choice assumes people are selfish.

Correction:

- Rationality places restrictions on *consistency of choice*, not on what people care about.
- Preferences can be altruistic, moral, social, or fairness-oriented.

Example: consistently choosing to donate to charity rather than keep money for oneself can be fully rational.

CLO1, CLO3

Misconception 2: "Utility means happiness"

Claim: Utility measures happiness or psychological pleasure.

Correction:

- In standard economic theory, utility is a numerical representation of preferences.
- It encodes rankings of options, not emotional states or well-being.

Example: assigning higher utility to coffee than tea does not mean coffee makes the person happier, only that it is preferred.

CLO1, CLO3

Misconception 3: "Behavioural economics rejects formal theory"

Claim: Behavioural economics abandons mathematical models.

Correction:

- Behavioural economics uses formal models, just with different behavioural assumptions.
- It modifies or extends standard models rather than discarding them.

Example: models with limited attention or reference dependence are still axiomatic and mathematically precise.

CLO1, CLO3

Misconception 4: "Inconsistency is always an error"

Claim: Any violation of rational-choice axioms is a mistake.

Correction:

- Some environments are complex, making stable preferences difficult to define.
- Certain behavioural patterns can be adaptive responses to limited information or cognitive constraints.

Example: using simple rules of thumb may lead to inconsistencies but still perform well in practice.

CLO1, CLO3

Key methodological lesson

Good analysis requires a clear separation between:

- **Definitions:** what a model assumes and implies.
- **Evidence:** how people actually behave in experiments and real-world settings.

Behavioural economics is precisely about comparing these two and understanding when and why they diverge.

CLO1, CLO3

Policy and business applications: why the benchmark matters

Even when real behaviour deviates from the rational-choice benchmark, the benchmark remains essential for analysis and design.

It provides a disciplined starting point for thinking about decisions, markets, and policy.

CLO2, CLO3

Why the rational benchmark is useful (continued)

First-pass prediction

- The benchmark gives clear baseline predictions, such as how demand should respond to price changes.
- These predictions are often approximately correct and provide a reference point.

Diagnostic tool

- When behaviour deviates, the benchmark helps identify which assumption is likely failing:
  - completeness,
  - transitivity,
  - stability of preferences,
  - attention or information processing.

CLO2, CLO3

Why the benchmark is useful (continued): design implications

What should not matter under standard theory

- The benchmark highlights features that should be irrelevant if preferences are stable (e.g. framing or option order).
- When such features do matter in practice, this signals scope for behavioural intervention.

Guiding policy and business design

- The benchmark helps identify where changing constraints or the choice environment can improve outcomes.

CLO2, CLO3

Policy and business tools informed by the benchmark

Common applications include:

- simplifying forms and information to reduce cognitive load;
- designing better defaults and choice architecture;
- structuring menus to reduce errors and avoid dominated options.

These tools are motivated by comparing actual behaviour to benchmark predictions.

CLO2, CLO3

Key takeaway

Behavioural economics does not discard the rational benchmark.

Instead, it builds on it to design policies and business environments where individuals are more likely to achieve their own objectives, given real cognitive and behavioural constraints.

CLO2, CLO3

Exam relevance: what you must be able to do from Week 1

You should be able to:

- define: $\succeq$, $\succ$, $\sim$, $\mathcal{U}$, menu M, budget set B;
- state completeness and transitivity formally and explain each intuitively;
- convert between rankings and utility representations, and recognise monotone transformations;
- solve simple choice problems under certainty (including budget constraints);
- explain the descriptive vs normative distinction and why it matters.

Study tip: practise writing short, correct definitions; most mistakes are notation mistakes.

CLO2, CLO4

Exam-style MCQs (one correct answer each)

MCQ 1. Completeness of $\succeq$ means:

1. For all x, y, if $x \succeq y$ then $y \succeq x$.
2. For all x, y, either $x \succeq y$ or $y \succeq x$ (or both).
3. For all x, y, z, if $x \succeq y$ and $y \succeq z$, then $x \succeq z$.
4. For all x, it is not the case that $x \succ x$.

MCQ 2. The definition of $x \succ y$ is:

1. $x \succeq y$ and $y \succeq x$
2. $x \succeq y$ or $y \succeq x$
3. $x \succeq y$ and $\neg(y \succeq x)$
4. $\neg(x \succeq y)$ and $y \succeq x$

MCQ 3. In standard theory under certainty, utility is best interpreted as:

1. a measure of happiness in the brain
2. a numerical index representing preference ordering
3. the amount of money a person has
4. the moral value of a choice

Short answer and long answer prompts

Short answer (6-8 lines):

- Explain the difference between descriptive and normative claims about decision-making.
- Define $\sim$ and $\succ$ in terms of $\succeq$.
- Give an example of a violation of completeness and explain why it is a violation.

Long answer (structured):

- Present the axioms of rational preferences under certainty and explain how they support an ordering of alternatives. Illustrate with a worked example converting an ordering into a utility function, then solve a consumer choice problem on a budget set.

CLO2, CLO4

Answers to integrated activities (A and B)

Activity A (D vs N):

- (1) Descriptive.
- (2) Normative.
- (3) Descriptive.
- (4) Descriptive.

Activity B (violations):

- Scenario 1 violates completeness.
- Scenario 2 violates transitivity.
- Scenario 3 violates neither.

CLO2, CLO4

Answers to integrated activities (C)

Activity C (one possible solution):

- Ranking: $x \succ y \succ z \sim w$.
- Utility example 1: $u(x) = 3,\ u(y) = 2,\ u(z) = 1,\ u(w) = 1$.
- Utility example 2: $u(x) = 100,\ u(y) = 10,\ u(z) = 0,\ u(w) = 0$.

Week 1 topic checklist

This slide covers the Week 1 scope:

- Introduction to behavioural economics: purpose, scope, and the benchmark
- Origins (conceptual timeline) and why behavioural refinements were proposed
- Methods I: experiments, field evidence, identification basics
- Choice under certainty:
  - preferences as relations on $\mathcal{U}$
  - completeness and transitivity
  - $\succeq$, $\succ$, $\sim$
  - utility representation and monotone transformations
  - rational choice from menus
  - consumer choice: budget sets and optimisation (discrete and continuous)
- Behavioural critique under certainty: framing and context dependence (preview)

CLO1, CLO3, CLO4

Key takeaways

- Behavioural economics keeps economic discipline while improving behavioural foundations when needed.
- Rational choice under certainty begins with preferences as a relation $\succeq$ over a set of alternatives $\mathcal{U}$.
- Rational preferences satisfy completeness and transitivity; $\succ$ and $\sim$ are derived from $\succeq$.
- Utility is a numerical representation of a preference ordering (not automatically happiness).
- Utility represents orderings; only the ranking matters (ordinal utility).
- Rational choice selects a most preferred feasible option from a menu or budget set.

CLO1, CLO3, CLO4