
SPEA-V348 Management Science · Week 3 review

Decision making under uncertainty

The whole session, every slide, fully revealed. Read it without me in the room.

Wed Sep 9, 2026 (Labor Day took Monday)

The week at a glance

Mon Sep 7	Labor Day. No class
Wed Sep 9	Five criteria on one payoff table: maximax, maximin, minimax regret, Hurwicz, and equal likelihood, and the point is that they disagree
Reading	Taylor 13e, Chapter 12, pp. 574 to 582, stopping where “Decision Making with Probabilities” begins
Due	The Week 3 workbook, on Canvas. Tier 1: AI as a tool, with disclosure

ON THE SITE · the Week 3 page

The criteria widget, the two self-checks, a second table on the vendor (a caterer’s offer), and the workbook download all live here.

v348.jima.me/week/w03/



Session 1

Wed Sep 9

Three amounts of knowing, three kinds of problem

This week you have the least

Certainty

you know which state will happen. Pick the best payoff and go home

Risk

you have probabilities on the states. Expected value works: Week 4

Uncertainty

no probabilities. Expected value cannot be computed. Today's problem

*With no probabilities you cannot average. What replaces the average is a **critterion**: a stated rule about how much downside you can absorb.*

Taylor 13e, pp. 574 to 575. Monday was Labor Day, so this session carries the whole week.

The ice-cream vendor

The question this session answers

PUZZLE

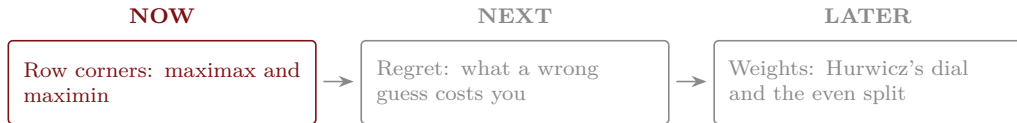
Before the season starts, a vendor must prep stock: **high**, **medium**, or **low**, then live with whatever summer arrives. No weather model, no history they trust. Season profit (\$):

Stock level	Hot summer	Cool summer
Stock high	2,400	-600
Stock medium	1,400	400
Stock low	700	700

You commit before the summer shows up. Every method today reads this one table.

Where we are

Five rules today, in three blocks



The vendor has three rows and no odds to weight them. The corners of each row give two opposite answers, regret puts a price on guessing wrong, and the weights let you say how optimistic you are before you commit.

A payoff table has named parts

Rows you control, columns you do not

Rows

the *decision alternatives*:
the stock levels. You choose
exactly one

Columns

the *states of nature*: the
summers. Nature chooses,
after you do

Cells

the payoff if you pick the
row and the column then
happens

*Every criterion below squeezes a **row** down to one number, and they differ only in **which** number they keep.*

Taylor 13e, pp. 574 to 575.

Where a payoff cell comes from

Stock medium in a Cool summer, built from the vendor's own prices

payoff = sales + salvage - cost of stock

Sales: the smaller of stock and demand, at \$6. Stock 700, a Cool summer buys 450: $6 \times 450 = 2,700$

Salvage: the 250 unsold clear at \$2 when the season ends: $2 \times 250 = 500$

Cost of stock: \$4 on all 700, whatever the summer does: $4 \times 700 = 2,800$. So $2,700 + 500 - 2,800 = 400$

Stock low / medium / high is 350 / 700 / 1,200 units at \$4; a Hot summer buys everything up to 1,200, a Cool one 450. Every cell comes out of this one line, and the take-home hands you the prices, not the table.

Before any criterion: look for a dominated row

The one free move in the whole game

- A row beaten in **every** state by some other row is **dominated**. Nothing will ever pick it, so delete it before you start.
- Here there is nothing to delete: Stock high wins under Hot, Stock low wins under Cool, and Stock medium is best in neither but worst in neither.
- That is exactly *why* the five rules ahead can disagree. A table with a free lunch would not need them.

Screen for dominance first, every time. This week's take-home grades that habit directly.

What it looks like when a row IS dominated

Two comparisons, and no attitude toward risk

A pricier distributor sells the same **medium** stock for \$200 more, in any summer.

Stock level	Hot	Cool
Stock high	2,400	-600
Stock medium	1,400	400
Stock low	700	700
Stock medium, pricier distributor	1,200	200

- Beside **Stock medium**: 1,200 against 1,400 in Hot, 200 against 400 in Cool.
- It loses in **every** state, so Stock medium **dominates** it. Strike it out.

*Two comparisons and **no rule at all**. The take-home hands you a row like this one and grades whether you struck it out first.*

The optimist and the pessimist

Same table, opposite corners of each row

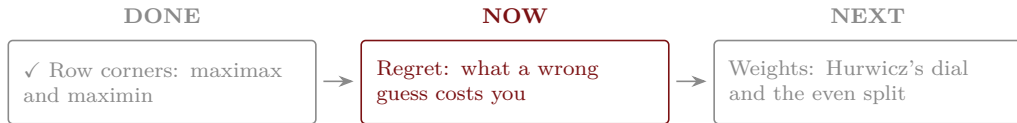
Stock level	Hot	Cool	Row best	Row worst
Stock high	2,400	−600	2,400	−600
Stock medium	1,400	400	1,400	400
Stock low	700	700	700	700

- **Maximax** keeps each row's **best** and picks the biggest of them: **Stock high**, chasing the 2,400.
- **Maximin** keeps each row's **worst** and picks the biggest of those: **Stock low**, guarding the 700 floor.

*They disagree already, and neither is wrong. Each encodes an **attitude toward risk**, not an error.*

Where we are

Two rules down, three to go



Maximax chased the 2,400 and stocked high, maximin guarded the 700 floor and stocked low, and no row is dominated, so the table will not break that tie for you. Regret asks what neither corner can: what each row costs you once the summer is known.

Regret: the cost of having guessed wrong

Computed against the winner in each state, not against zero

regret = column best – your payoff

Column best: what the winner got in that state. In a Hot summer, 2,400

Your payoff: what your choice returned in that same state. Stock low: 700

The difference: what you left on the table. $2,400 - 700 = 1,700$

Also called the Savage criterion, or opportunity loss. Taylor 13e, pp. 575 to 579.

The full regret table

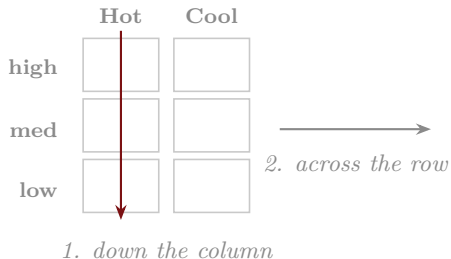
Stock level	Hot	Cool	Max regret
Stock high	0	1,300	1,300
Stock medium	1,000	300	1,000
Stock low	1,700	0	1,700

Minimax regret keeps each row's **largest** regret and takes the smallest of them: 1,000 beats 1,300 and 1,700, so **Stock medium**. A third rule, a third row.

Notice every column carries a **zero**: the row that won that state regrets nothing.

Watch the direction

The one mechanical mistake this table invites



First, down each column: find the column's best payoff, then subtract every cell from it. Regret is relative to that state's winner

Only then, across each row: keep the largest regret, and pick the row where that worst case is smallest

*Maximax and maximin scan a row. Regret starts **down a column**. Swapping the two directions is the most common regret-table mistake.*

Where we are

Three rules down, two to go



Regret is column best minus your payoff, and the smallest worst case is Stock medium at 1,000. Hurwicz asks how optimistic you are and turns your answer into a weight; equal likelihood answers for you, with 0.5 on each summer.

Hurwicz: your optimism, as a number

A dial between the pessimist and the optimist

The dial α , from 0 to 1: how much weight the good case gets. $\alpha = 1$ is pure maximax, $\alpha = 0$ pure maximin

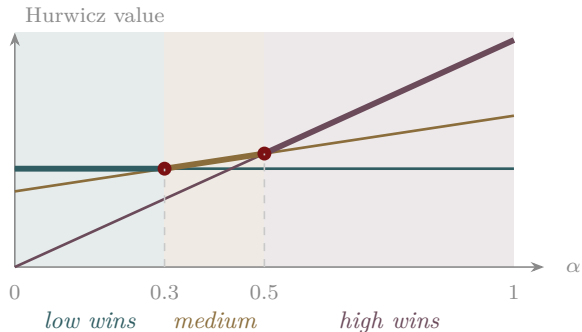
$$H = \alpha (\text{row best}) + (1 - \alpha) (\text{row worst})$$

What is left goes to the bad case, so the two weights always spend exactly 1

On the table, at $\alpha = 0.6$: Stock high = $0.6(2,400) + 0.4(-600) = 1,200$

α is the coefficient of optimism. At $\alpha = 0.6$ the rows score 1,200 / 1,000 / 700. Taylor 13e, pp.575 to 579.

Slide the dial and watch the winner change



$$\text{high: } H = \alpha (2,400) + (1 - \alpha) (-600)$$

$$\text{medium: } H = \alpha (1,400) + (1 - \alpha) (400)$$

$$\text{low: } H = \alpha (700) + (1 - \alpha) (700)$$

Each row's Hurwicz value is a straight line in α , so a crossing is one equation: medium passes low where $\alpha (1,400) + (1 - \alpha) (400) = 700$, that is $400 + 1,000\alpha = 700$, so $\alpha = 0.3$. The pick passes through all three rows on its way up.

What the crossings decide

A threshold on your optimism, not a curiosity of the chart

- Each crossing is a **threshold**: past 0.5 stocking high beats stocking medium, and past 0.3 a vendor only three-tenths optimistic already leaves the safe row.
- So **state your α before you see the payoffs**, then read off which side of each crossing you are on. Argue about the side, not the decimal: 0.6 and 0.9 agree, 0.45 and 0.55 do not.
- A row **never on top** at any α is out, the same free move as dominance. Here all three get a turn; the take-home asks if the booth's middle row does.

ON THE SITE · the criteria widget

Press Hurwicz: the same lines are drawn under the dial with the crossings marked. Drag α and watch.

v348.jima.me/week/w03/



Equal likelihood: pretend the states are even

Weight each summer 0.5, then read the row average

Stock level	Hot $\times 0.5$	Cool $\times 0.5$	Row average
Stock high	2,400	-600	$(2,400 - 600)/2 = \mathbf{900}$
Stock medium	1,400	400	$(1,400 + 400)/2 = \mathbf{900}$
Stock low	700	700	$(700 + 700)/2 = 700$

- High and medium **tie at 900**, ahead of low, yet this “neutral” rule still disagrees with maximin, which picked low. The criterion, not the data, drives the choice.
- Equal likelihood is **expected value with made-up probabilities**; next week the 0.5s become real numbers.

Refusing to pick an attitude is itself an attitude. Even the neutral rule is a choice.

Also called the Laplace criterion; with three states each weighs a third. Taylor 13e, pp. 575 to 579.

Five rules, one table, on your laptop

IN CLASS

Open the widget on the Week 3 page. Click **Maximax**, then **Maximin**, then **Minimax regret**: it rewrites the payoffs as regrets in front of you. Then click **Hurwicz** and drag α from 0 to 1, watching the highlighted row jump at 0.3 and 0.5, and finish with **Equal likelihood** and its tie. Watch the **last column**: it carries every row's score under the live rule, so maximin fills it with $-600 / 400 / 700$ and maximax with $2,400 / 1,400 / 700$, the same rows in the opposite order.

ON THE SITE · the criteria widget

The ice-cream table with every criterion live. The widget names its ties instead of hiding them.

v348.jima.me/week/w03/



In practice: the criterion reveals you, not the truth

IN PRACTICE

“No probabilities” is rarer than it looks. You usually have some prior: a hunch, a base rate, last year’s weather. These criteria are the honest fallback when that prior is too weak to trust.

People do not even obey their own criterion. Almost everyone buys insurance, though a pure payoff-maximiser “should” decline it: a dollar lost when you are broke hurts more than one gained when you are comfortable. That gap is *utility*, and Week 6 puts a curve on it.

The payoffs are estimates too: every cell rests on price, spoilage, and demand assumptions, so sanity-check the cells before the recommendation.

The criterion you choose is a statement about how much downside you can stomach. Own it out loud.

Back to the vendor

Five rules, three answers, one sentence to defend

Criterion	Picks	Because
Maximax	Stock high	only its row reaches 2,400
Maximin	Stock low	a guaranteed 700, the best floor
Minimax regret	Stock medium	worst-case regret of 1,000, the smallest
Equal likelihood	high or medium	both average 900, a genuine tie
Hurwicz	depends on α	low below 0.3, medium to 0.5, high above

*The defensible answer is a sentence, not a number: “We are under **uncertainty**, I am protecting against a bad season, so by **maximin** I stock low.”
Environment, criterion, decision.*

This week's take-home

One file, on Canvas, by Sunday at 11:59 PM

- A **fall-festival pumpkin booth**, and no payoff table is given to you: build it from a case-priced grower quote, the booth price, and the compost partner's salvage. Screen the premium row for **dominance**, then work **all five** criteria.
- The last cell finds the **tipping point**: the weight at which your Hurwicz answer changes, and whether the middle order is *ever* the pick; its answer is not today's.

ON THE SITE · the brief and the workbook

Download the workbook here. **Tier 1**: AI as a tool, with the disclosure cell filled in.

v348.jima.me/week/w03/



Carry into Week 4

5 rules

one table, three answers

α

your optimism, as a
number

regret

column best minus your
cell

uncertainty

the environment you
were in

*Next week the probabilities **come back**. Weight each column by its real chance and the five rules collapse into one: **expected value**, deciding between whole strategies.*

Group practice

Fifteen minutes, with your group

IN CLASS

A campus makerspace must lease **one** equipment package before signups open, with no membership history to lean on. Fill in each package's row min and row max, circle what maximax and maximin choose, build the regret table from scratch, and recommend a package to a space that cannot afford a bad first year. **Every member's name goes on the sheet**; one of you photographs it and **uploads the photo to Canvas** before you leave. One participation point, half today's attendance record.

ON THE SITE · Week 3 practice sheet

The same sheet is on the site if you want it on a screen.

v348.jima.me/assets/docx/v348-w03-s1-group-practice.docx



Photograph your attempt, then check it together

Two minutes to capture your work; eight for the instructor's demonstration

IN CLASS

Check every member's name and photograph your group's own attempt before the solution is shown. One member uploads the photo to Canvas by the end of class.

We close by checking the method, the main results with units, and a common mistake. Participation credit is for attempting the work.

Review

Week 3

Can you define these without looking?

Twelve terms this week introduced

uncertainty	payoff table	decision alternative	state of nature
dominance	maximax	maximin	regret
minimax regret	Hurwicz	coefficient of optimism	equal likelihood

ON THE SITE · Key Concepts

Every one of these has a one-line definition and a worked example behind it. Filter by week.

v348.jima.me/concepts/



Definitions: the table and its screen

Uncertainty	The environment with no probabilities on the states. Certainty and risk are the other two
Payoff table	Decision alternatives as rows, states of nature as columns, a payoff in each cell
Decision alternative	A row: the thing you control and must commit to
State of nature	A column: the thing you do not control, revealed after you commit
Dominance	One row beats another in every state; the beaten row can be deleted before any criterion runs

Definitions: the five criteria

Maximax	Keep each row's best payoff, pick the biggest. The optimist
Maximin	Keep each row's worst payoff, pick the biggest of those floors. The pessimist
Regret	Column best minus your cell: what you left on the table in that state
Minimax regret	Keep each row's largest regret, pick the row where it is smallest. Also: the Savage criterion
Hurwicz	$\alpha(\text{row best}) + (1 - \alpha)(\text{row worst})$, with α the coefficient of optimism
Equal likelihood	Average each row as though the states were equally likely. Also: the Laplace criterion

Test yourself

If one of these is slow, that is where to reread

1. Stock low pays 700 in every summer and the caterer's contract pays 1,000 in every summer. Which criterion is a flat row built to please, and why does Stock low leave the table before that rule even runs?
2. Why does every column of a regret table contain at least one zero?
3. Hurwicz at $\alpha = 1$ and at $\alpha = 0$ collapse into which two other criteria?
4. A colleague calls the middle row "the safe compromise." What would you compute to test whether any optimism weight actually makes it the Hurwicz pick?
5. Equal likelihood is "expected value with made-up probabilities." What replaces the made-up part next week, and what does that change about the answer?

Numbers worth remembering

\$700

the floor maximin
protects, stock low

\$1,000

the smallest max
regret, stock medium

\$900

the equal-likelihood tie,
high and medium

0.3, 0.5

where the Hurwicz pick
jumps rows

Criterion

On the ice-cream table

The move

Maximax

Stock high

biggest row best, 2,400

Maximin

Stock low

biggest row worst, 700

Minimax regret

Stock medium

smallest max regret, 1,000

Carry into Week 4

- Week 4 puts the **probabilities back** on the states. The same payoff table, one new row of numbers along the top, and the five rules collapse into **expected value**.
- Regret survives the upgrade: weighted by probabilities it becomes **expected opportunity loss**.
- The habit stays the same: name the environment first, because it decides which tools you are allowed to reach for.

ON THE SITE · Week 4

The reading and the before-class self-check are posted. Do the self-check before Monday.

v348.jima.me/week/w04/

