Research & Discovery week

CENTER FOR TEACHING & LEARNING

LOBOLEARN

An AI-Powered Adaptive Learning Platform for UNM

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UNM RESEARCH & DISCOVERY WEEK, 2025

Nov 14, 2025

📍 Albuquerque, NM, USA

Motivation

STUDENTS
LEARN
DIFFERENTLY

TRADITIONAL
ASSIGNMENTS
ARE STATIC

REPEATED
PRACTICE
LEARNING

*Our goal is to help **every student learn***
at their own pace and reach mastery.

Our Objectives

1. Enable students to practice solving **different variants** of same concept repeatedly until mastery.
2. **Incentivize** students to repeat questions until mastery is achieved.
3. Provide **real-time feedback** about their current mastery level to the student.

[LR] Student-Question Model

3 Parameter Logistic Model to describe the interaction between students and questions. The **question response function** is given by:

$$\mathbb{P}(\text{student } i \text{ answers question } j \text{ correctly})$$

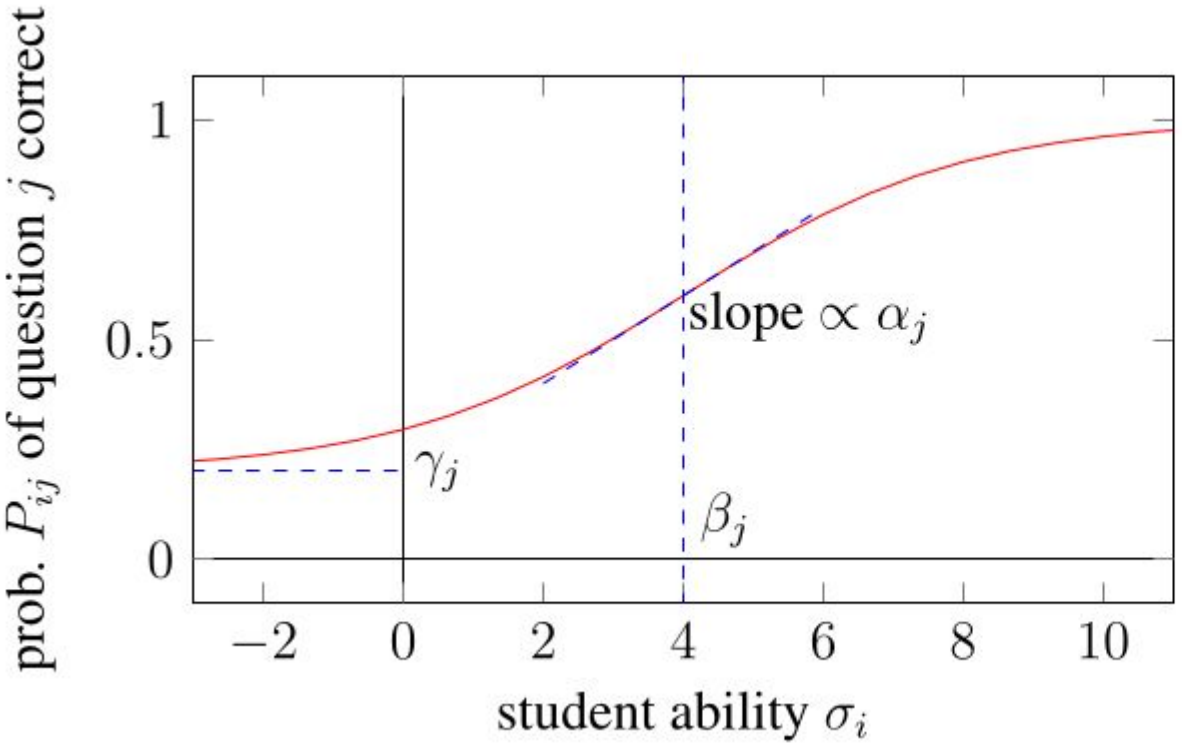
$$= f(\sigma_i, \theta_j) = \gamma_j + \frac{1-\gamma_j}{1+e^{\alpha_j(\beta_j - \sigma_i)}}$$

student ability

three dimensional vector $\rightarrow \theta_j = (\alpha_j, \beta_j, \gamma_j)$

West, Matthew, Geoffrey L. Herman, and Craig Zilles. "Prairielearn: Mastery-based online problem solving with adaptive scoring and recommendations driven by machine learning." 2015 ASEE Annual Conference & Exposition. 2015.

Model Analysis



σ_i = Ability of student i

α_j = Discrimination of question j

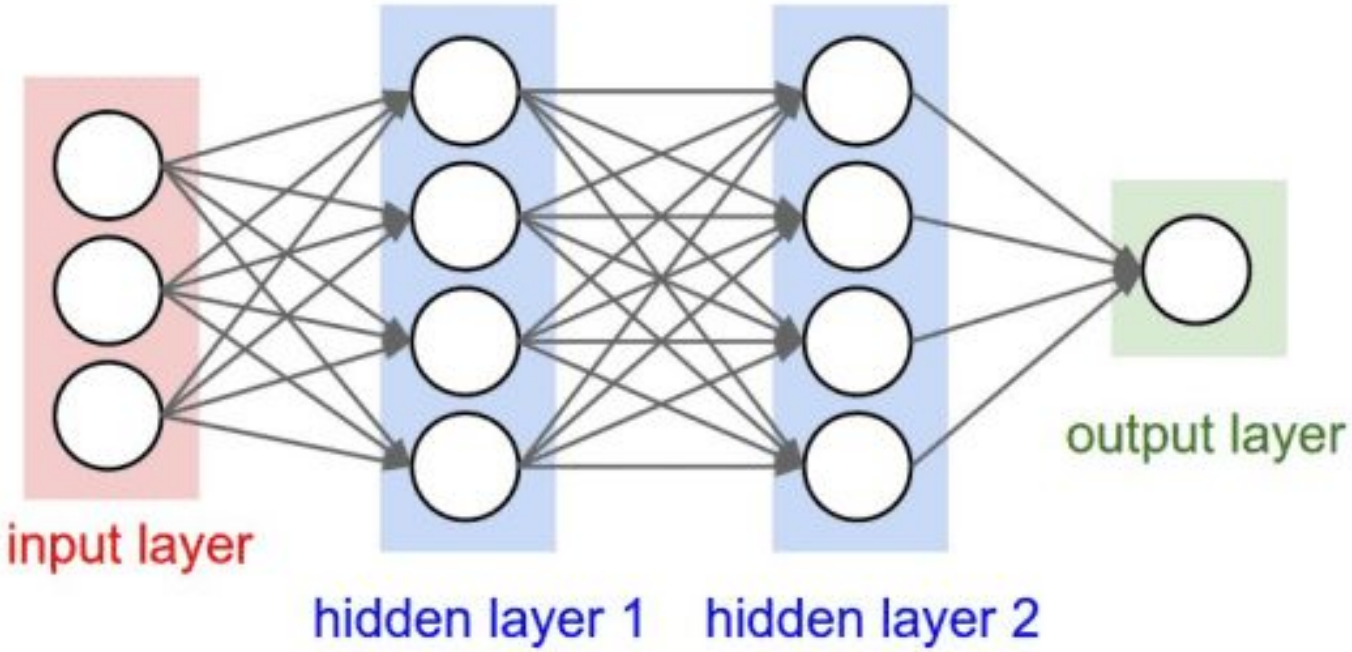
β_j = Difficulty of question j

γ_j = Chance of guessing question j

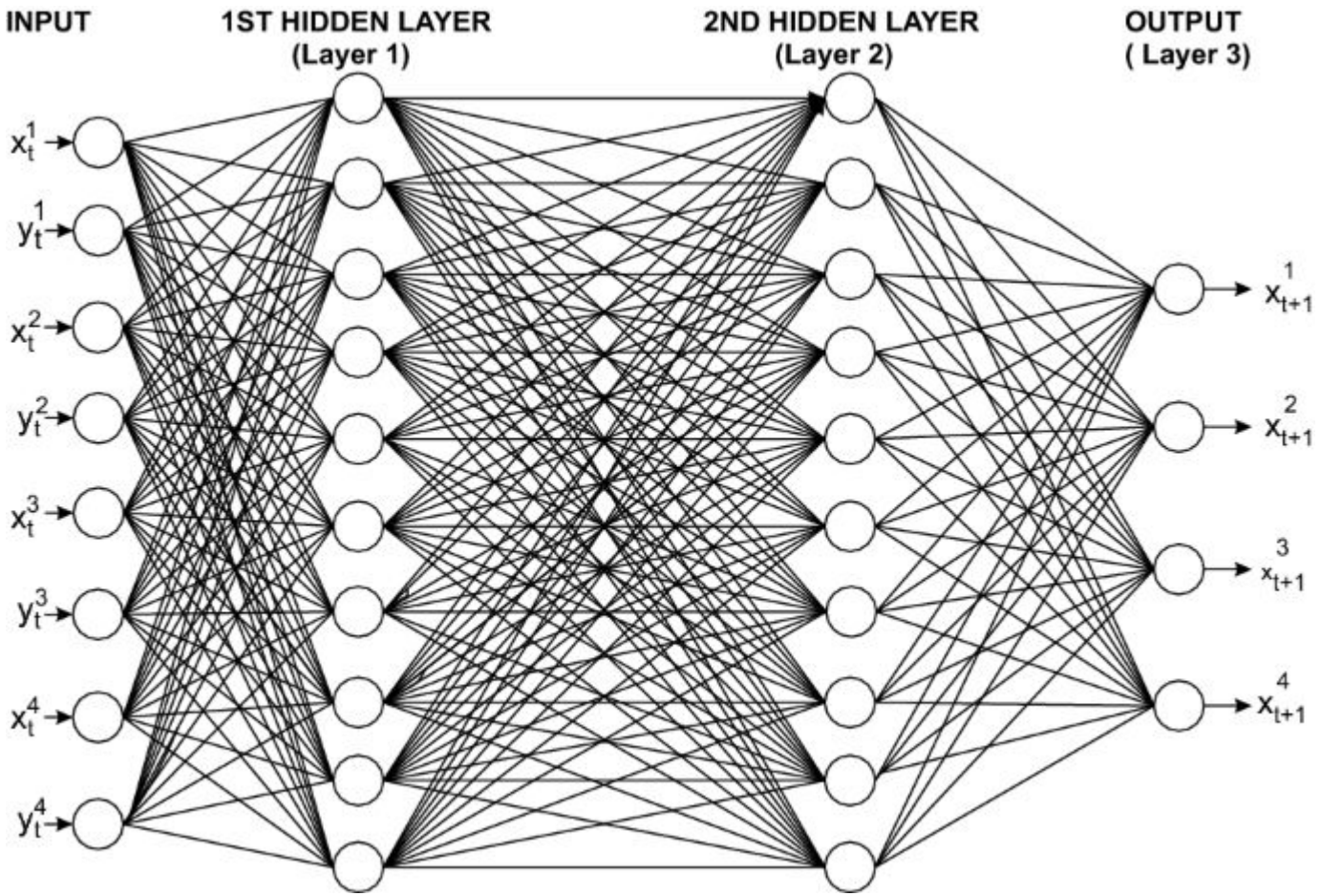
$\theta_j = (\alpha_j, \beta_j, \gamma_j)$

West, Matthew, Geoffrey L. Herman, and Craig Zilles. "Prairielearn: Mastery-based online problem solving with adaptive scoring and recommendations driven by machine learning." 2015 ASEE Annual Conference & Exposition. 2015.

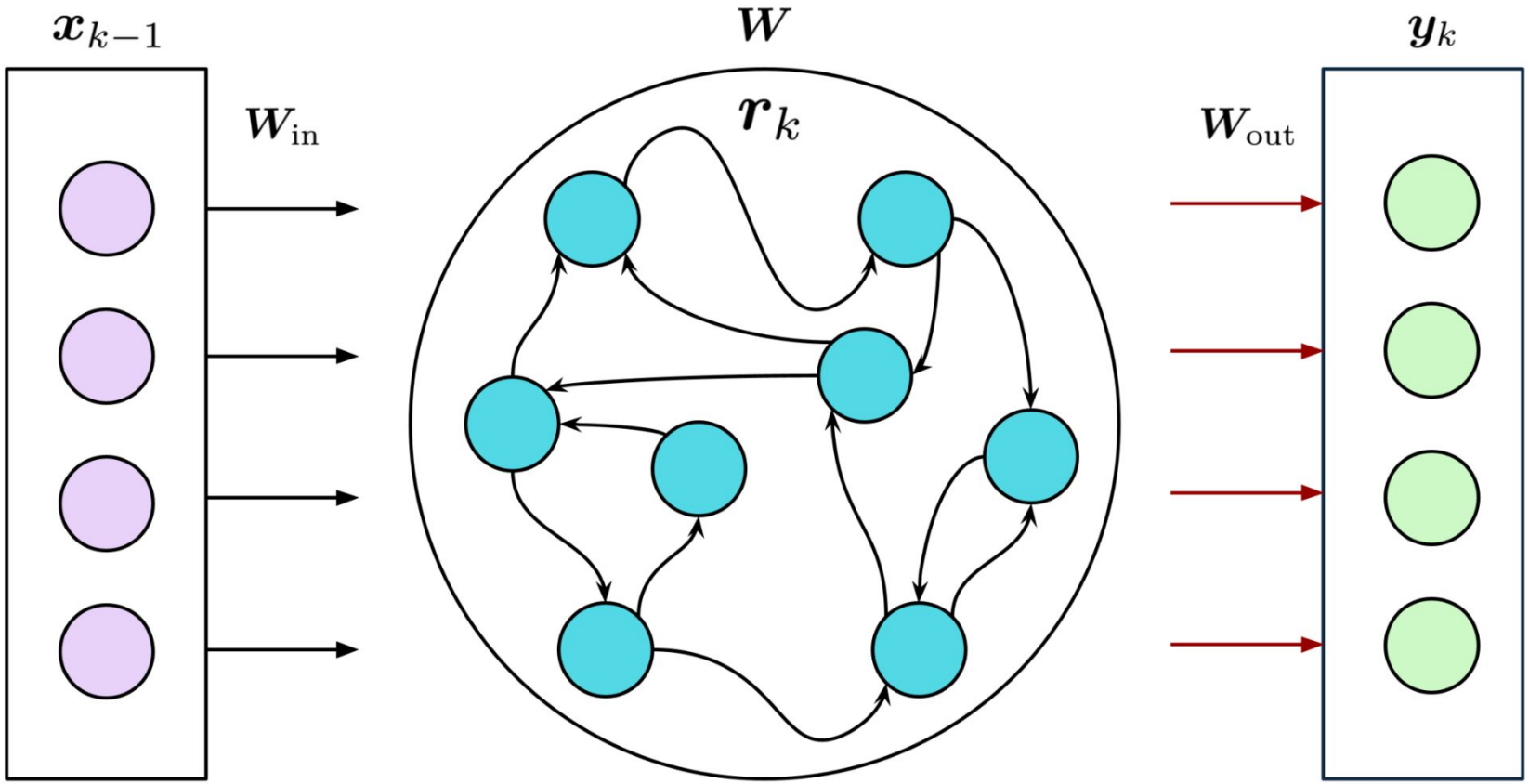
Neural Network



Dense Network



Reservoir Computer

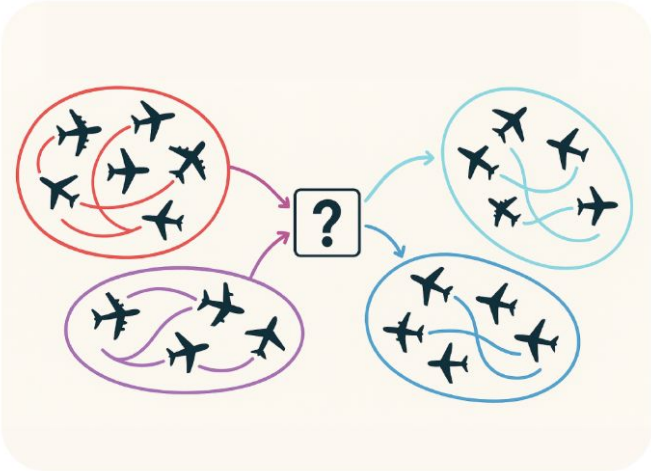


Real Time Feedback + New Variant Feature

02 | Introduction to ML View...

Identify the type of machine learning used in the following scenario.

Scenario: An algorithm clusters thousands of aircraft flight trajectories based on similarity without knowing what each group means.



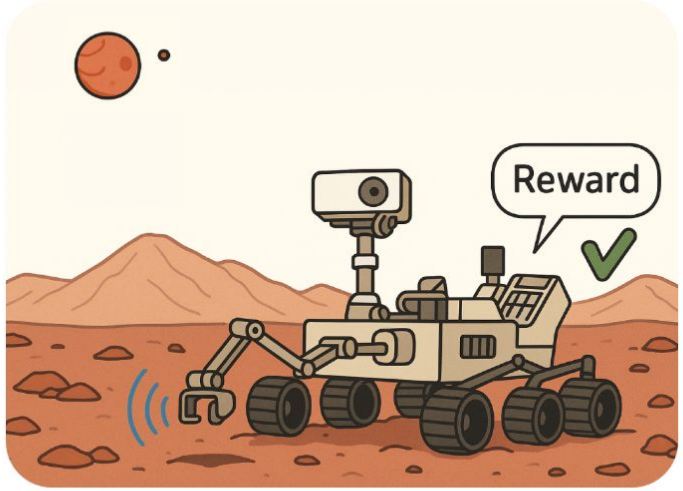
- (a) Supervised Learning
- (b) Unsupervised Learning
- (c) Reinforcement Learning

Save & Grade | Save only | New variant

02 | Introduction to ML View...

Identify the type of machine learning used in the following scenario.

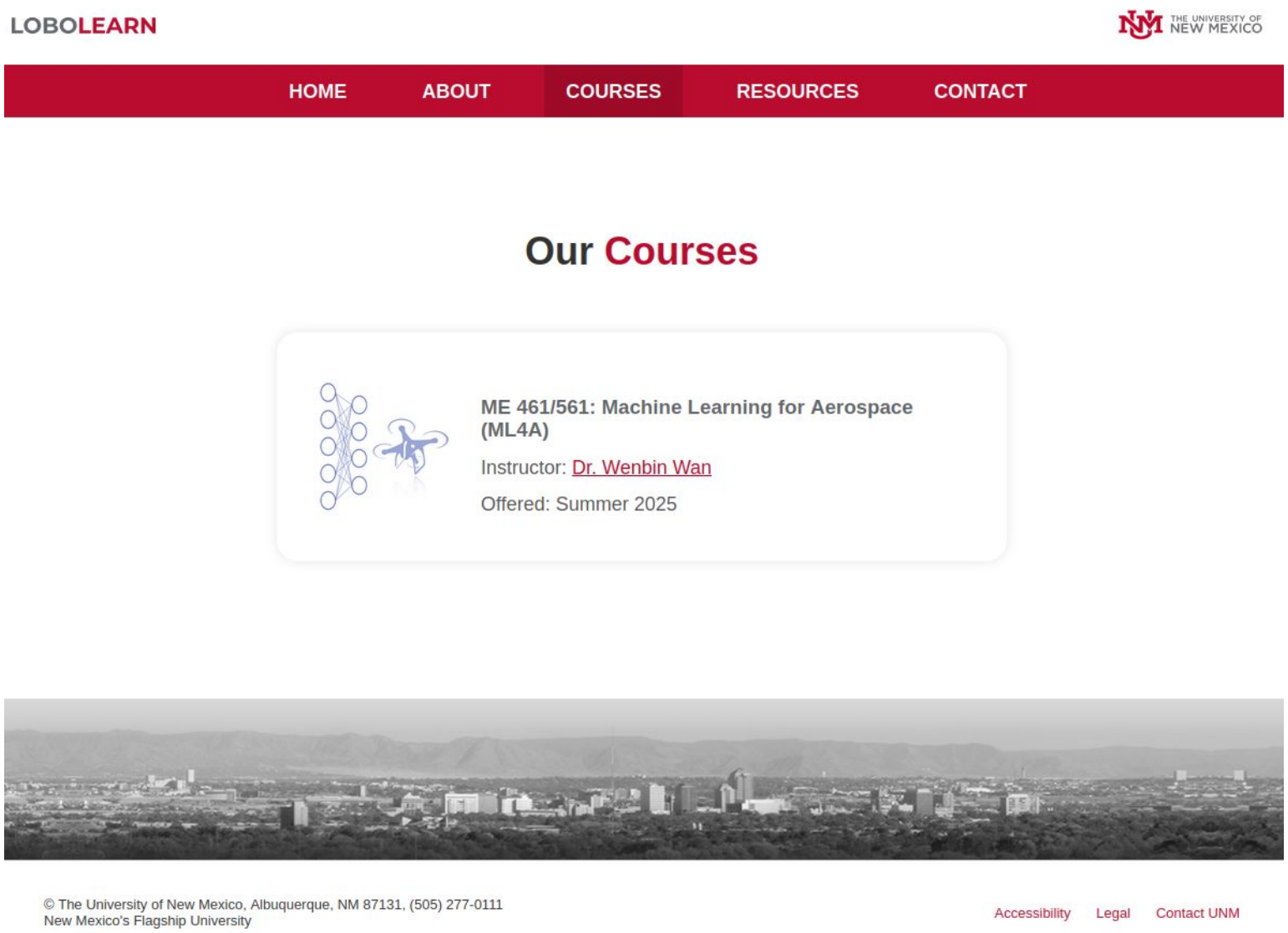
Scenario: A Mars rover improves its navigation by exploring terrain and receiving feedback based on safe travel.



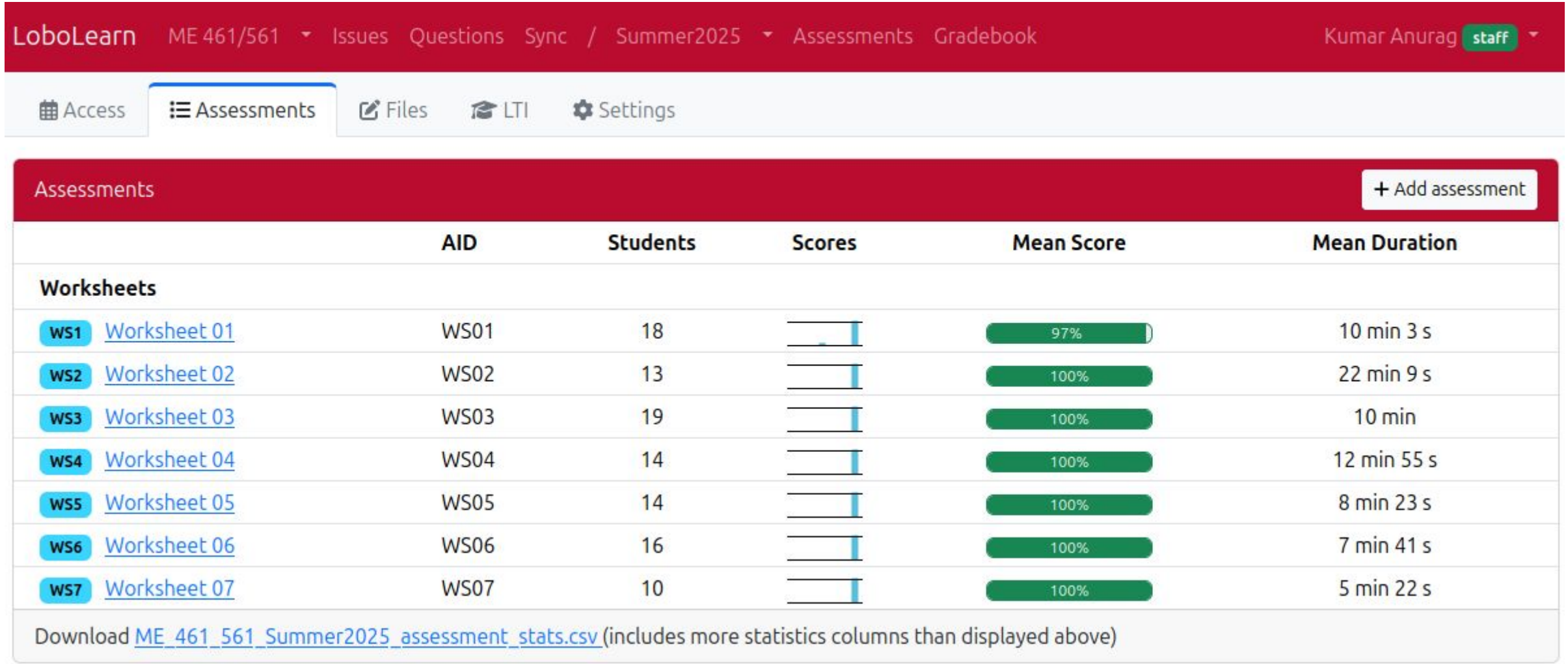
- (a) Supervised Learning
- (b) Unsupervised Learning
- (c) Reinforcement Learning

Save & Grade | Save only | New variant

Implementation

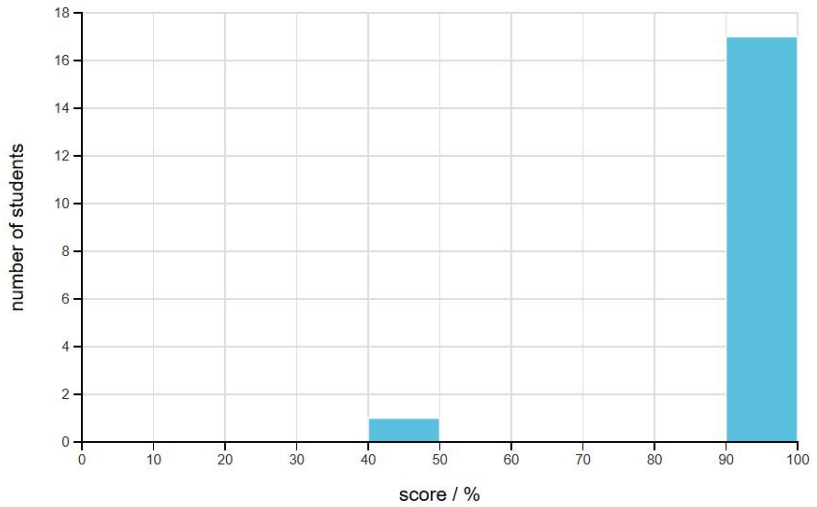


Designing Course



Score Statistics

Worksheet 1: Score statistics

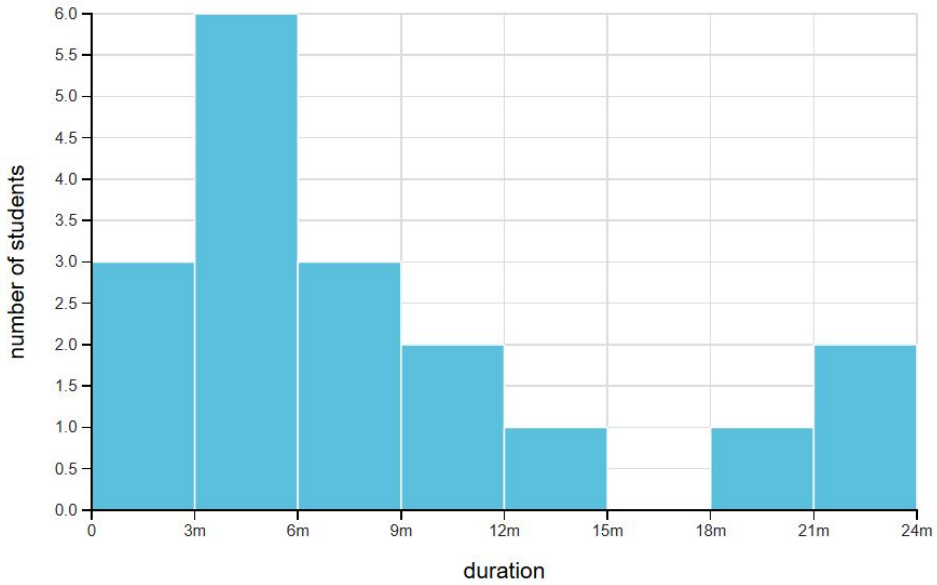


Number of students	18
Mean score	97%
Standard deviation	14%
Median score	100%
Minimum score	40%
Maximum score	100%
Number of 0%	0 (0% of class)
Number of 100%	17 (94% of class)

Download ME_461_561_Summer2025_WS1_score_stats.csv. Data outside of the plotted range is included in the last bin.

Duration Statistics

Worksheet 1: Duration statistics

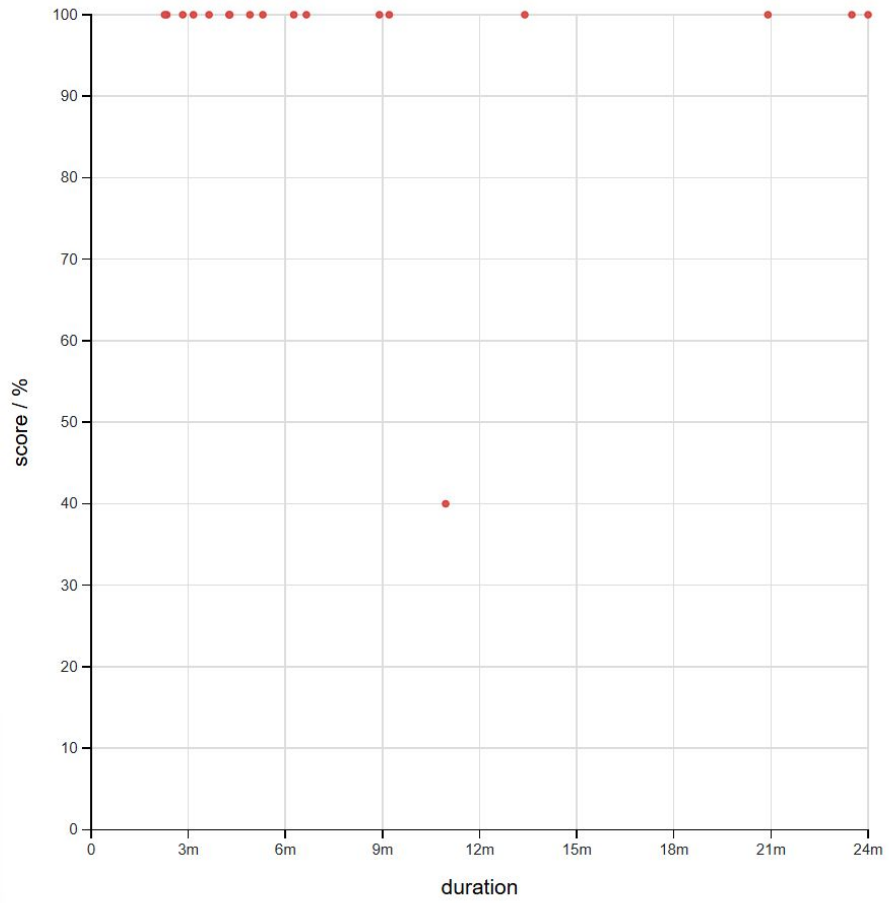


Mean duration	10m
Median duration	5m
Minimum duration	2m
Maximum duration	48m

Download ME_461_561_Summer2025_WS1_duration_stats.csv. Data outside of the plotted range is included in the last bin.

Duration vs Score Analysis

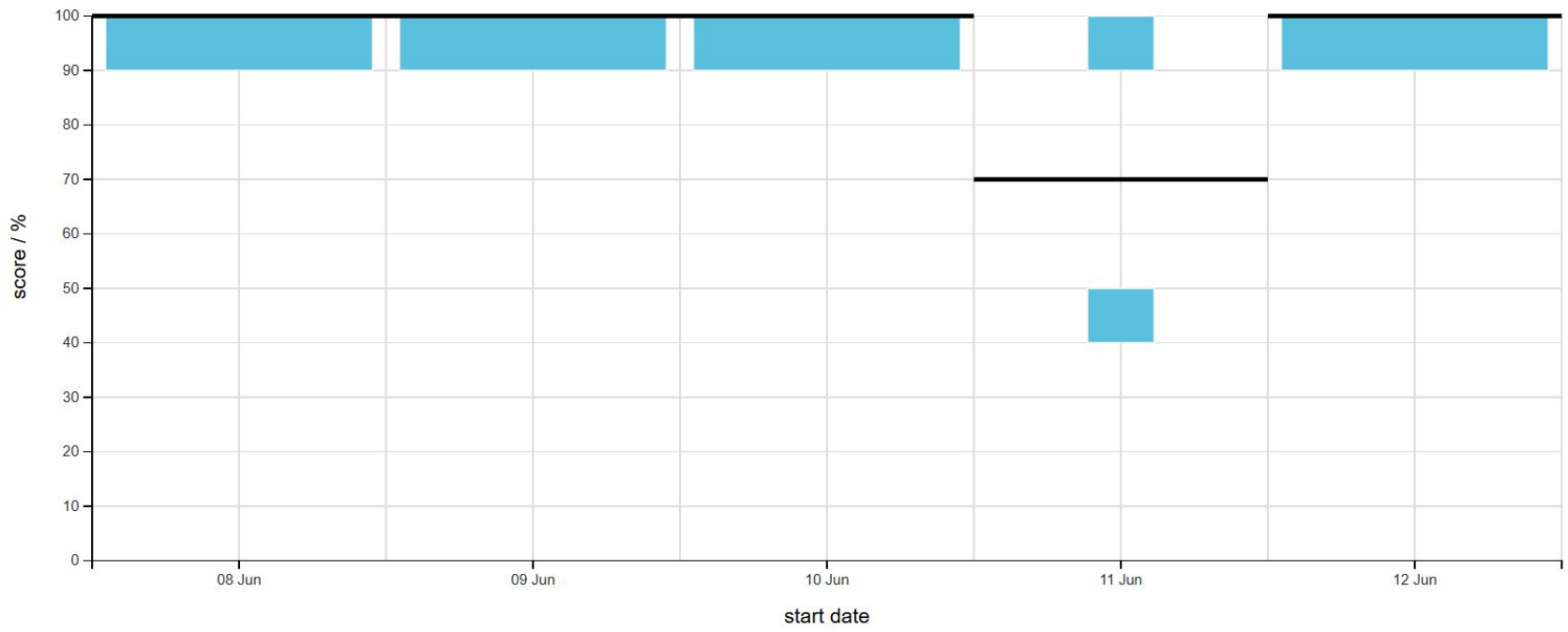
Worksheet 1: Duration versus score



Each point is one student assessment. Points beyond the plot range are plotted on the edge.

Consistent Performance over Time

Worksheet 1: Score statistics by date



Download ME_461_561_Summer2025_WS1_scores_by_date.csv.

Each day shows a histogram of the scores on this assessment for that day. The widths are scaled relative to the maximum value across all bins and days. The thick black horizontal lines are the mean scores for each day.

New Variant Statistics

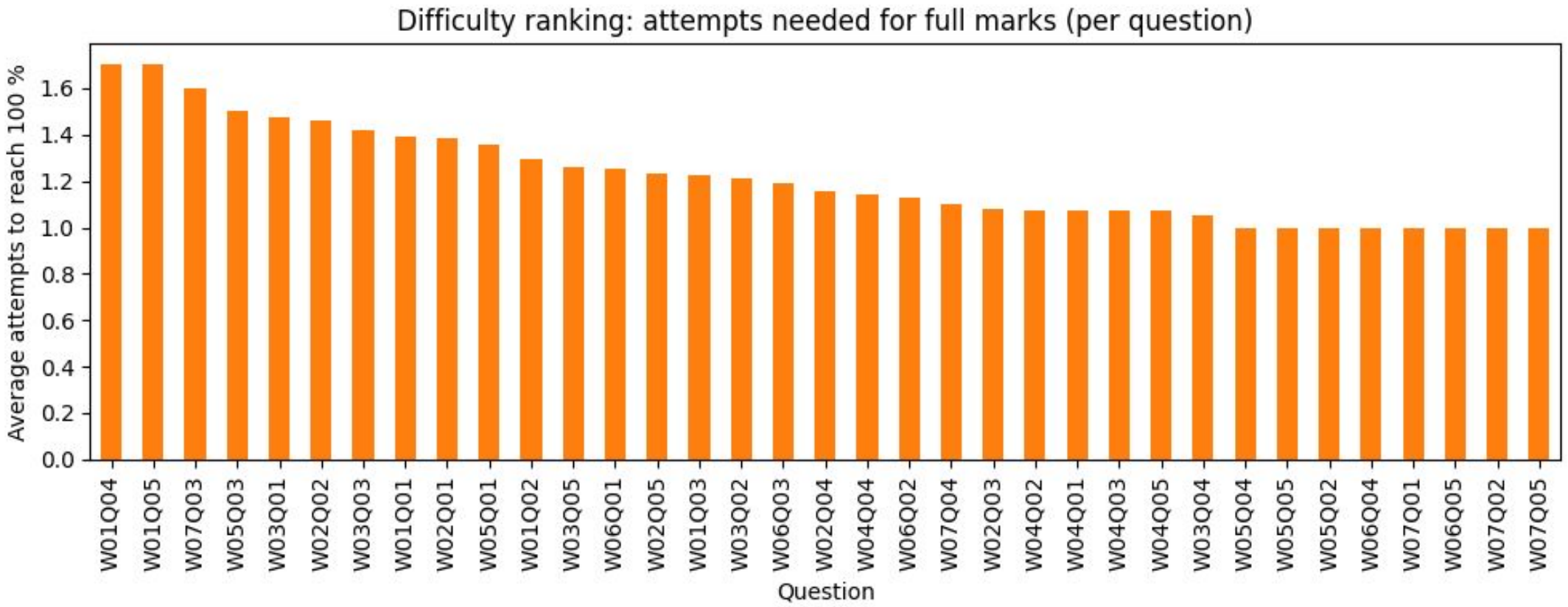
WS1: Worksheet 01

Total points: 50/50 100%

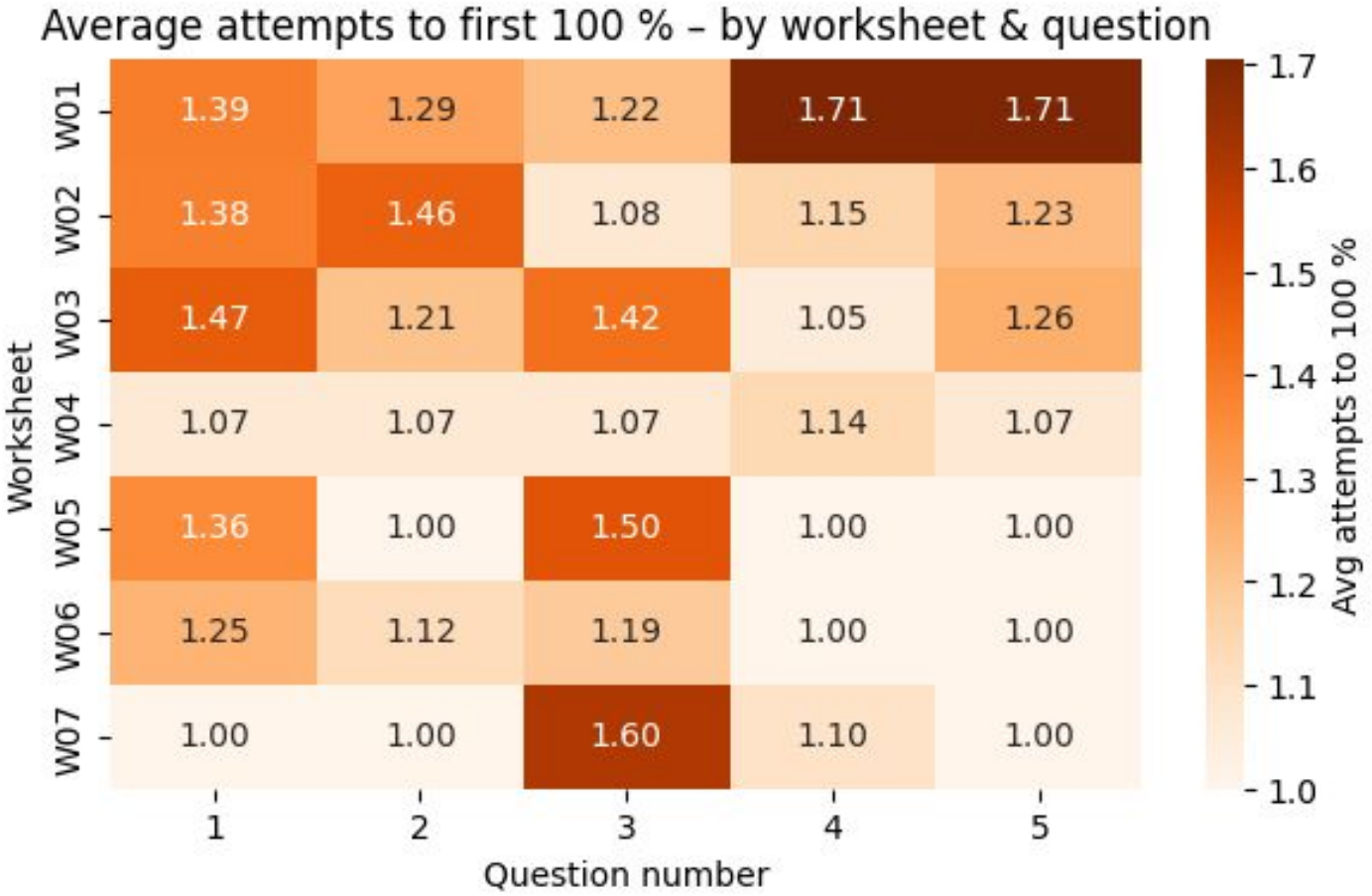
Assessment is **closed** and you cannot answer questions.

Question	Value	Variant history	Awarded points
Worksheet 01			
WS1.1. 01 | Introduction to ML	10	33% 100%	10 /10
WS1.2. 02 | Introduction to ML	10	0% 100%	10 /10
WS1.3. 03 | Introduction to ML	10	100%	10 /10
WS1.4. 04 | Introduction to ML	10	100%	10 /10
WS1.5. 05 | Introduction to ML	10	0% 0% 100%	10 /10

Identifying Challenging Questions



Overall Analysis



TEACHING ALLOCATION GRANT 2024-25

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Thank you!

Questions & Discussion

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THE UNIVERSITY OF NEW MEXICO

OPTIMIZATION AND ESTIMATION LAB

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