Example: Domain Model Using CRC Cards

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Outline


Recording

These slides accompany a recorded video: *Play Video*


Example of Early Analysis

This lesson works through an example of the early stages of analysis.

- Available documentation is natural language, fairly general in nature
  - Natural language is always tricky to work with. Ambiguities and contradictions are common.
  - You must read carefully and critically.


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  - Reveal questions for later, more detailed follow-up
- Mistakes will be made!

Outline I


Problem Statement I

ODU offers a number of courses via the internet. A common requirement among these courses is for a system of online assessment. An assessment is any form of graded question-and-answer activity. Examples include exams, quizzes, exercises, and self-assessments. In preparation for automating such a system, our group has undertaken a study of assessment techniques in traditional classrooms.

An assessment can contain a number of questions. Questions come in many forms, including true/false, single-choice from among multiple alternatives, multiple choices, fill-in-the-blank, and essay. There may be other forms as well.

Students take assessments that are administered by instructors. The students' responses to each question are collected by the instructor, who grades them by comparison to a rubric for each


Problem Statement II

question. The instructor may also elect to provide feedback (written comments), particularly about incorrect responses.
A total score for the assessment is computed by the instructor. If this is a self-assessment, the score is for informational purposes only. For other kinds of assessments, the instructor records the score in his/her grade book.
Information is returned to the student about their performance. At a minimum, the student would learn of their score and any instructor-provided feedback. Depending upon the instructor, students may also receive the questions, a copy of their own responses, and the instructor's correct answer.


Outline I


Identifying Candidate Classes and Responsibilities I

For the initial list, mark up the description, looking for *noun phrases* and verb phrases .

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An assessment can contain a number of *questions* . Questions come in many forms, including *true/false* , *single-choice* from

Identifying Candidate Classes and Responsibilities II

among multiple alternatives, *multiple choices* , *fill-in-the-blank* , and *essay* . There may be other forms as well.
Students take assessments that are administered by *instructors* . The students' *responses* to each question are collected by the *instructor* , who grades them by comparison to a *rubric* for each question. The instructor may also elect to provide *feedback* (written comments), particularly about incorrect responses.
A total *score* for the assessment is computed by the instructor. If this is a self-assessment, the score is for informational purposes only. For other kinds of assessments, the instructor records the score in his/her *grade book* .
Information is returned to the student about their *performance* . At a minimum, the student would learn of their score and any

Identifying Candidate Classes and Responsibilities III

instructor-provided feedback. Depending upon the instructor, students may also receive the questions, a copy of their own responses, and the *instructor's correct answer* .


Candidate Classes

assessment, exams, quizzes, exercises, self-assessments, questions, true/false question, single-choice question, multiple choices question, fill-in-the-blank question, essay question, students, instructors, responses, rubric, feedback, score, grade book, information, performance, instructor's answer

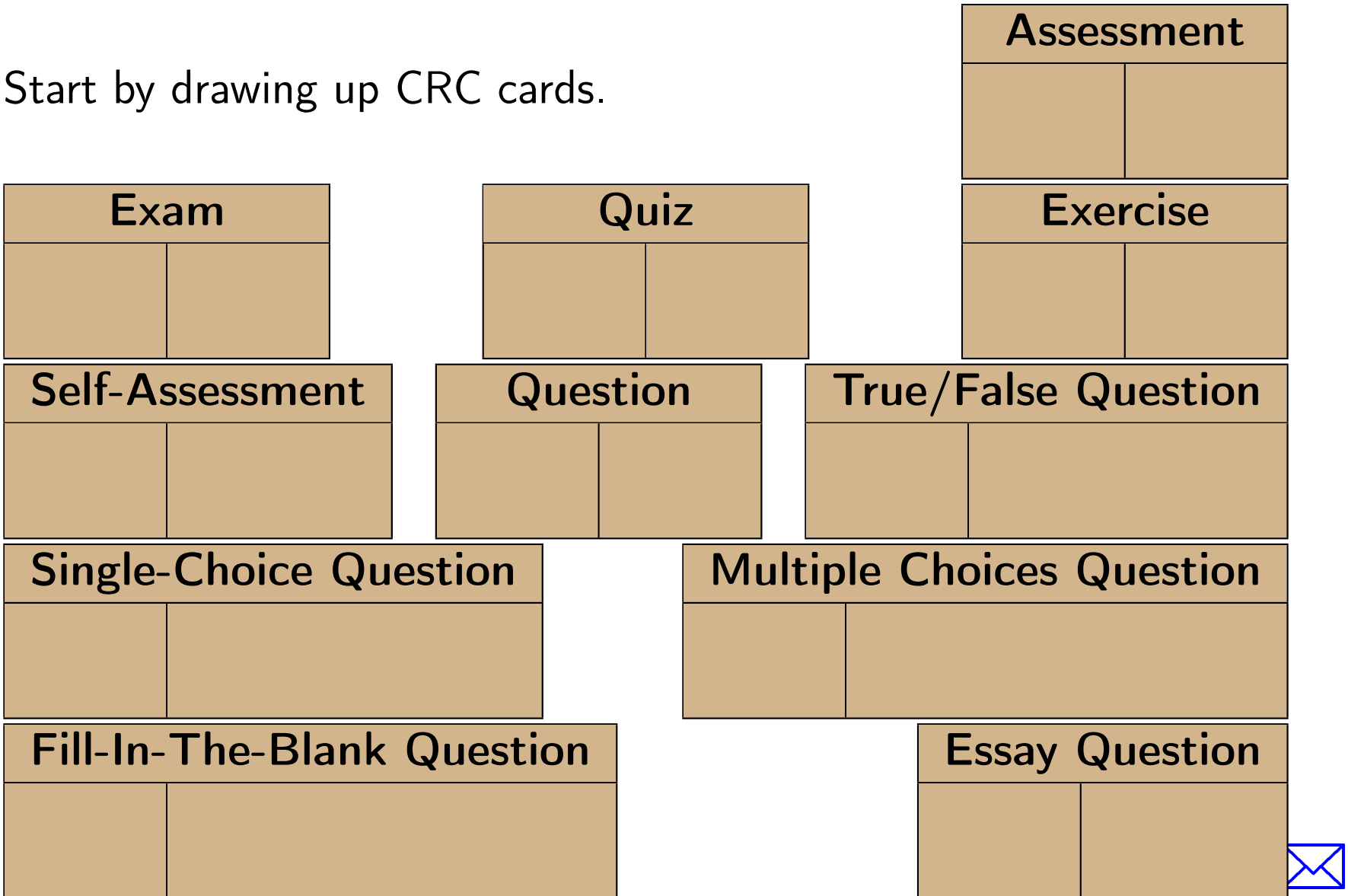

Candidate Responsibilities

contain (questions), take (assessment), administer, collect (responses), grade, provide (feedback), compute (score), record (score), return (information)


Outline I


Assign Responsibilities to Classes I

Start by drawing up CRC cards.



Assign Responsibilities to Classes II

Student	

Instructor	

Response	

Rubric	

Feedback	

Score	

Grade Book	

Information	

Performance	

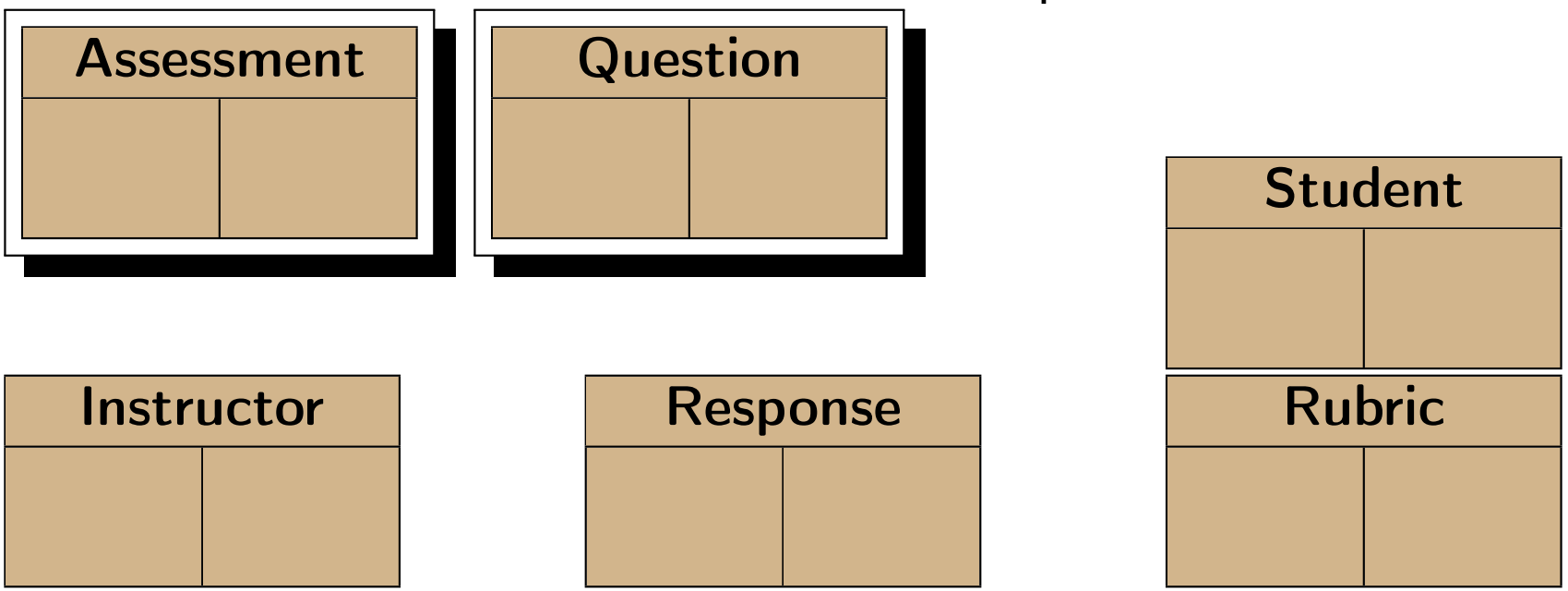
Correct Answer	


Outline I

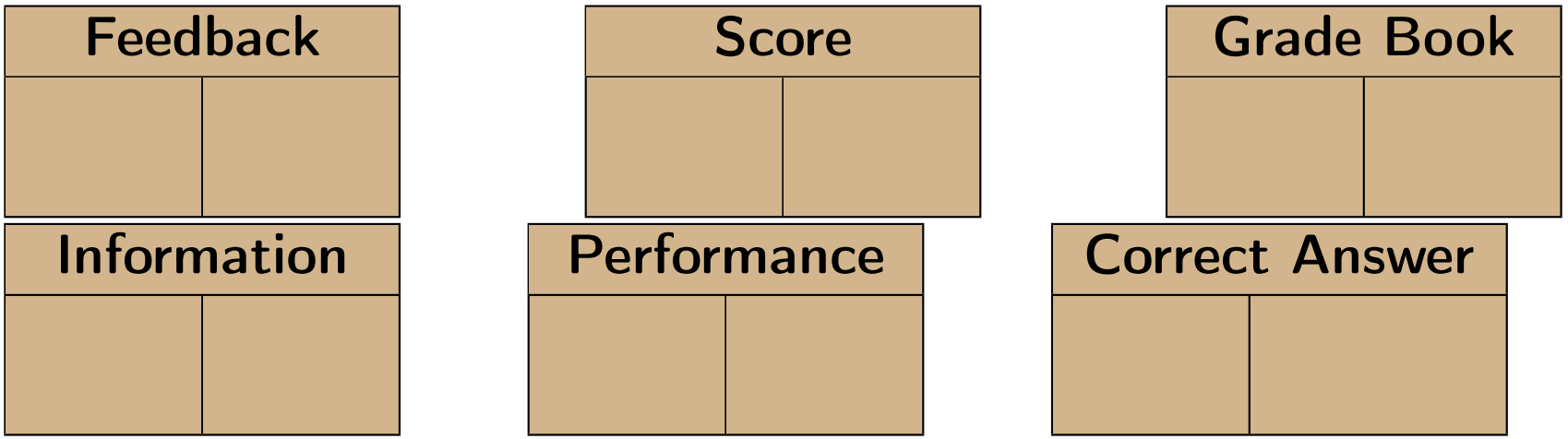

Probable Inheritance Hierarchies I

Since all of the various kinds of assessments are likely to have similar responsibilities and collaborators, let's stack their cards for now and treat them as a unit.

We'll do the same with the various kinds of questions.



Probable Inheritance Hierarchies II



Outline I


Fill in the Candidate Responsibilities

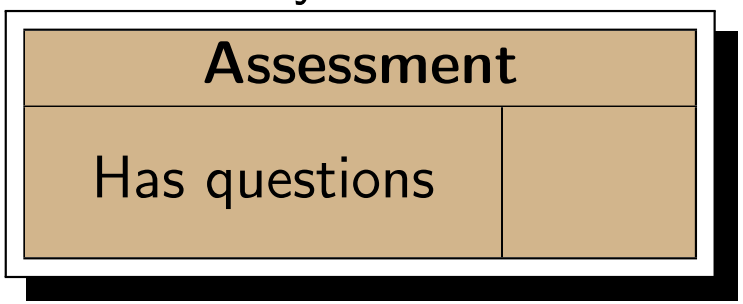
Now fill in the operations known so far:

- contain (questions)
- take (assessment),
- administer,
- collect (responses),
- grade,
- provide (feedback),
- compute (score),
- record (score),
- return (information),


contain questions

An assessment can contain a number of *questions* .

- This is really a statement about attributes of an assessment



taking and administering assessments

Students take assessments that are administered by *instructors* .

- Is this really two separate operations?
  The language (plurals) is a bit tricky.
  - Instructors administer an assessment to an entire class.
  - Each student individually takes the assessment.

Instructor	
administer assessment to group of Students	

Taking or Administering?

- Surprised that I put that in Instructor?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  - Tests don't administer themselves ITRW


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  Remember the basic rule: if A does B to C, then "do B" is usually a responsibility of C
- It would not be a responsibility of the assessment
  - Tests don't administer themselves ITRW
- Could it be a responsibility of the Student?
  - No, the statement says that students "take"assessments,
  - But is "take assessment" simply a synonym for "accept administration of an assessment"?


What's involved in administering an assessment?

The problem statement tells us:

> Students take assessments that are administered by instructors. The students' responses to each question are collected by the instructor, who grades them . . . The instructor may also elect to provide feedback (written comments), particularly about incorrect responses.
> A total score for the assessment is computed by the instructor.. . . Information is returned to the student about their performance.

We're looking at the instructor's *method* for administering an assessment.

- a strong suggestion that administration of an assessment is far more involved than simply having a student "take" it.
  - and that they are, therefore, separate responsibilities.


taking an assessment

So we add the student's role into our model:

Student	
take an Assessment	Assessment

Instructor	
administer assessment to group of Students	Student

collecting responses

The students' *responses* to each question are collected by the *instructor*

- This is really just describing the output from the request sent to students asking them to take the assessment.

Student	
take an Assessment : Response	Assessment

grading responses

the *instructor* , who grades them by comparison to a *rubric* for each question.

Response	
grade	

Instructor	
administer assessment to group of Students	Student Response

- not a responsibility of the instructor, because we are still tracing out the steps that constitute the instructor's method for administering an assignment


Working with Rubrics

We are told there is a separate rubric for each question. So the "comparison" is between a response to a single question and a rubric.

- This highlights the distinction between the response to an assessment and the responses to individual questions.
  - We don't know what the proper terminology here would be, so we use a placeholder and make a note to consult the domain experts.

Response	
has QuestionResponses? grade all question responses via a seq of Rubrics	Rubric

QuestionResponse?	
grade(Rubric): score	


Wait a minute...

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At this point, sanity reasserts itself

- ITRW, when a student returns an exam sheet or a bluebook (the Response), those things don't grade themselves.


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  - And while anthropomorphism is common in OO modeling, that may be going a little too far.


What are our options?

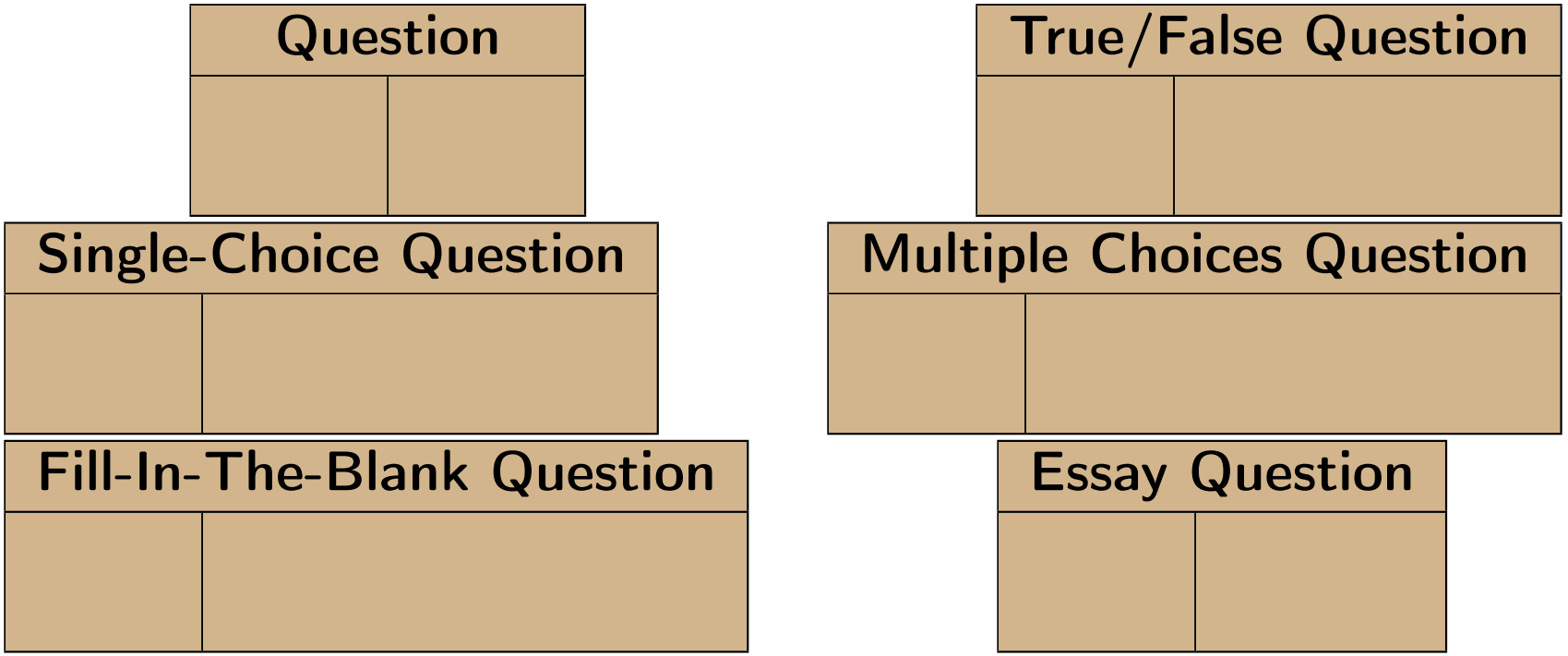
Response	
has QuestionResponses? ~~grade a seq of Questions via a seq of Rubrics~~	~~Rubric~~

QuestionResponse?	
~~grade(Rubric): score~~	

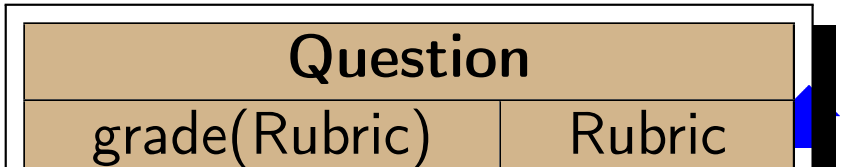
- First thought: the instructor does the grading
  - but it's not really a responsibility of the instructor because no one in this model tells the instructor to take this step
  - it's part of the Instructor's "administer an assessment" method
- But not mentioning it all in the model seems wrong
  - So let's think about what we want to eventually capture


Looking for Variant Behavior

One reason that we really want to model the grading process is that we know that we have many different kinds of questions:



and we suspect that the grading method varies from one type of question to another.



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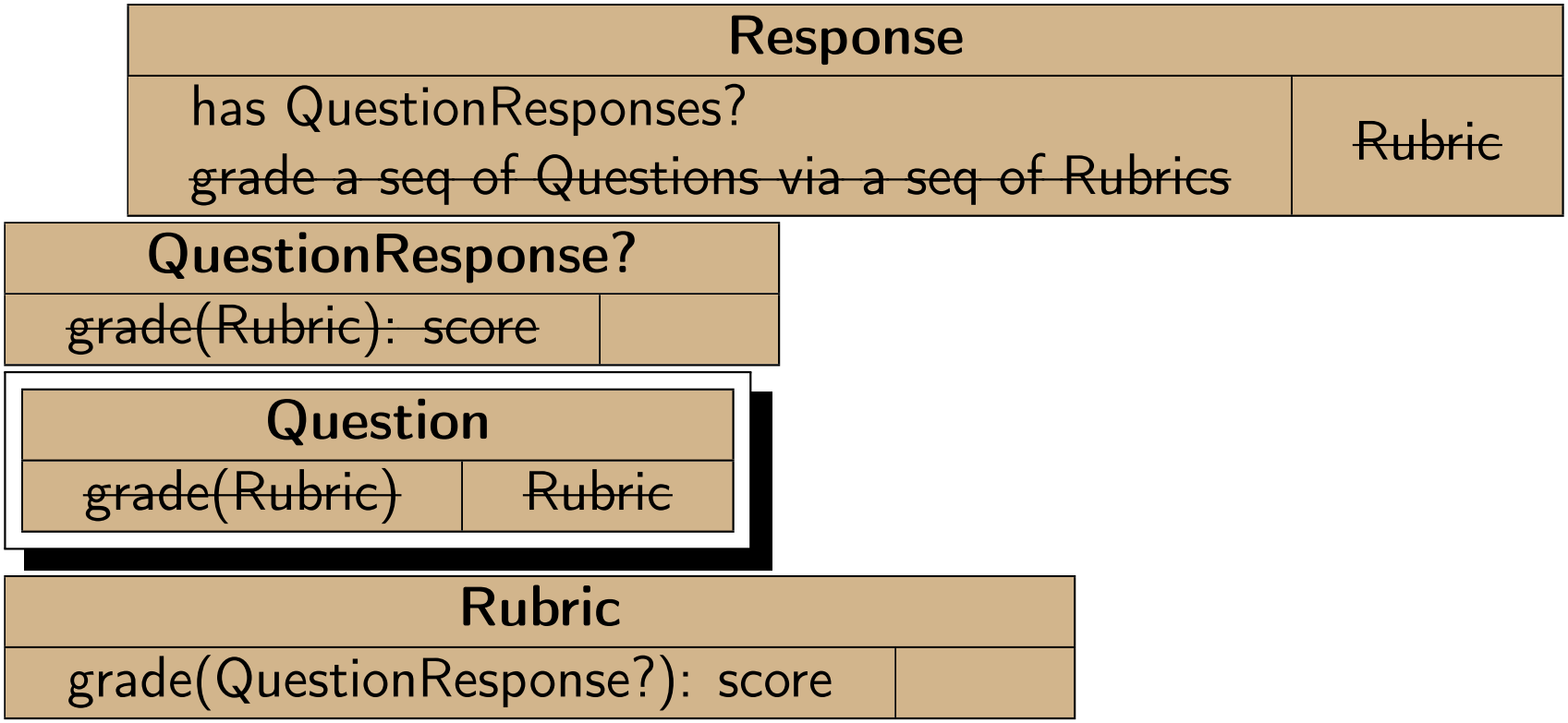
- Are these really the same kind of question?
  - They share lots of behaviors (e.g., they are represented the same way on the printed page, students use the same mechanism for answering them)
  - But the rubrics for grading them are very different
- So maybe it's the rubrics that capture this behavior


Grading - revised



- I'm much happier with that
- Can rubrics be "intelligent" or is this unacceptable anthropomorphism again?
  - ITRW, rubrics for essay question, in particular, are often expressed in ways that assume a human intelligence
- We're probably going to wind up with a small deck of Rubric

provide feedback

The instructor may also elect to provide *feedback* (written comments), particularly about incorrect responses.

GradedQuestionResponse?	
Has score, feedback	

- Another case of needing to consult the domain experts to find the proper name for a graded question response.

computing scores

A total *score* for the assessment is computed by the instructor.

GradedResponse?	
has GradedQuestionResponses compute total score	

recording grades

the instructor records the score in his/her *grade book* .

GradeBook	
record a score for a Student on an Assessment	

Instructor	
administer assessment to group of Students	Student Response Grade Book

returning information

Information is returned to the student about their *performance* .

- It's a pretty good bet that we *don't* want a class with as vague a name as "Information".
- But we've already encountered the concept under a better name
  The clue is the description: "At a minimum, the student would learn of their score and any instructor-provided feedback."

Student	
take an Assessment: Response receive a GradedResponse	Assessment


Outline I


The Story So Far I

Assessment	
Has questions	

GradeBook	
record a score for a Student on an Assessment	

GradedQuestionResponse?	
Has score, feedback	

GradedResponse?	
has GradedQuestionResponses? compute total score	

Instructor	
administer assessment to group of Students	Student Response Grade Book


The Story So Far II

Question	
~~grade(Rubric)~~	~~Rubric~~

QuestionResponse?	
~~grade(Rubric): score~~	

Response	
has QuestionResponses? ~~grade a seq of Questions via a seq of Rubrics~~	~~Rubric~~

Rubric	
grade(QuestionResponse): score	

Student	
take an Assessment: Response receive a GradedResponse	Assessment


The Story So Far III

We might (cautiously) question whether some of the empty cards represent classes that we need to retain in the model.

- But we're still very early in the discovery process

That's Far Enough for Now

Right now, we have as many questions as answers.

- but finding useful questions is part of the process
- We can't go much further without more info
  - . . . and it's very dangerous to start making stuff up based on intuition about how we think the program could work.