

Learning Trajectories

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Announcements

This is CMSC 209, Computers for Learning - NOT Intro to Data Science

Readings are due prior to class, not accepted late for credit (unless hospitalization, etc.)

Cannot change syllabus, so lab attendance is not for credit. Just remember that students who attend lab do better in the class, and we won't extend deadlines due to procrastination.

Midterm will be a take-home, non-timed exam, so no proctoring / special circumstances apply

Basic Learning Strategies (inspired by Constructivism)

Incrementally teach material

Build on prior knowledge (in school and at home)

Designing Curriculum: Theory: Constructivism



= 1



= 2



= 3



= 4



= 5



= 6



= 7



= 8



= 9

Designing Curriculum: Theory: Constructivism



Designing Curriculum: Theory: Constructivism

1	2	3
4	5	6
7	8	9

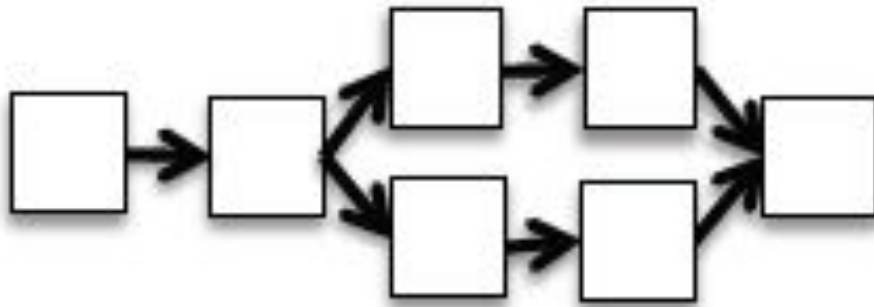
Designing Curriculum: Theory: Constructivism



What is a Learning Trajectory?

- A learning trajectory is a path from students' existing knowledge to some particular learning goal.
- One useful way to conceptualize an LT is to think of it as having three components¹:
 - An overarching learning goal;
 - A partially ordered list of waypoints that suggest a pathway to the learning goal; and
 - A set of learning activities that help students move along the path.

How does theory influence Learning Trajectory shape?

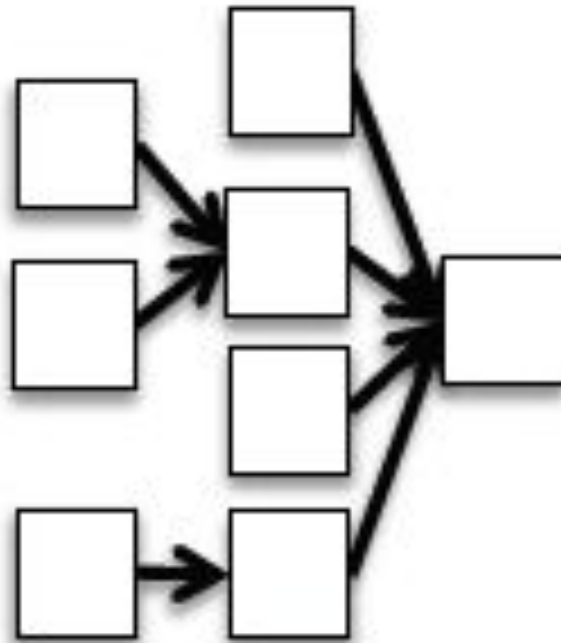


(a) Learning Progression

Pieces of Knowledge

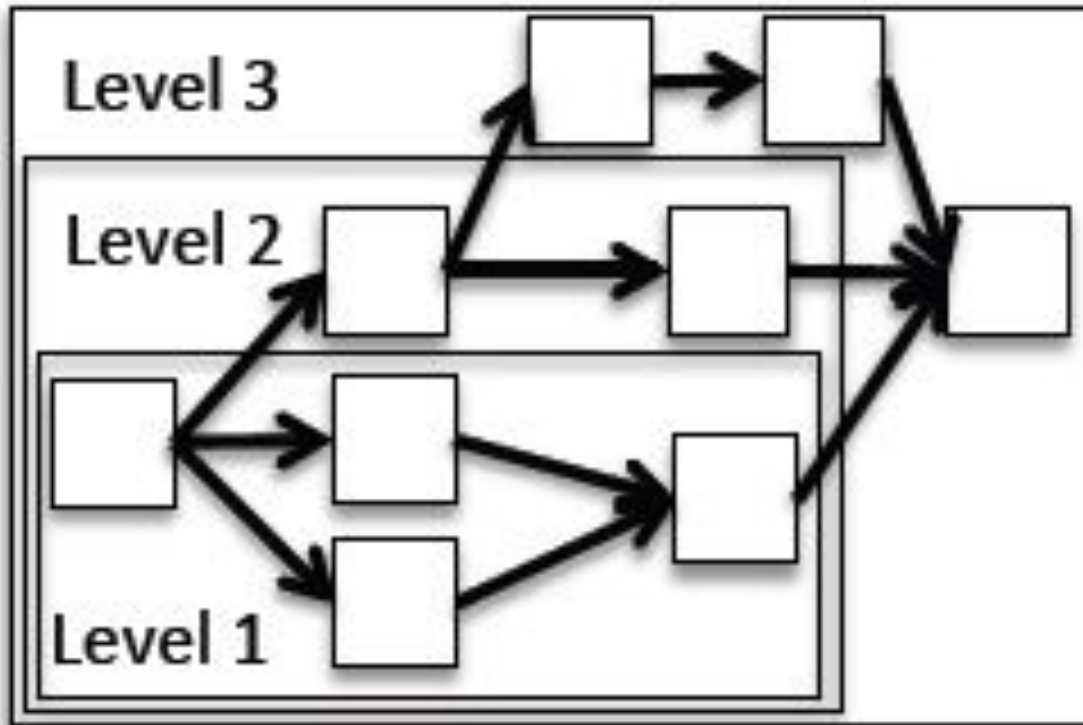
- What factors influence order in which knowledge is learned?
- How is Pieces of Knowledge different from prior views of Learning Progressions?

How does theory influence Learning Trajectory shape?



(b) Pieces of Knowledge

How does theory influence Learning Trajectory shape?



(c) Spiral Curriculum

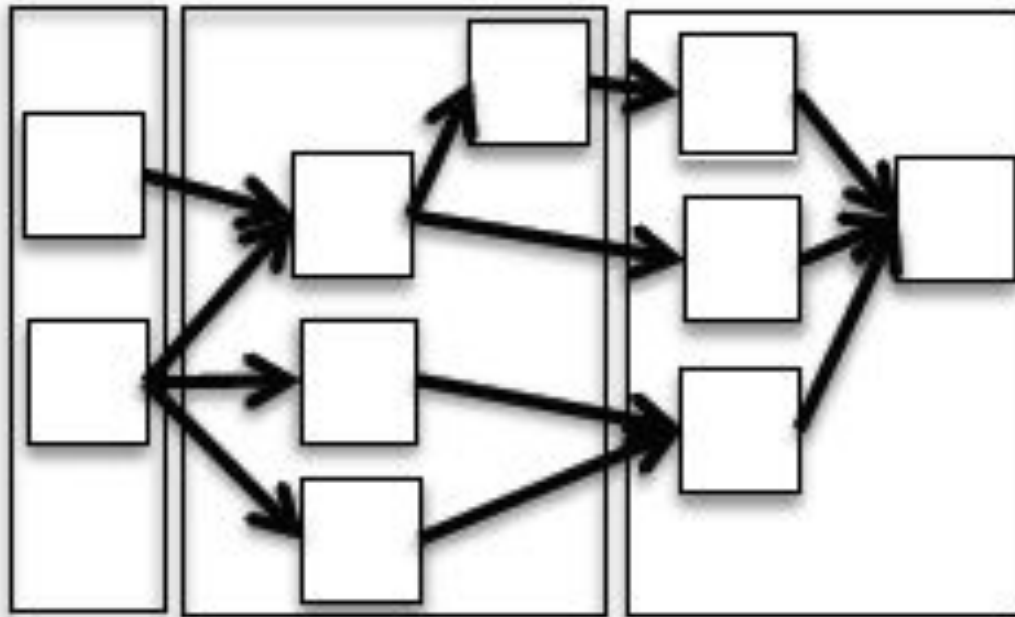
Spiral Curriculum – 3 key aspects

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- Same concepts revisited
- Revisited in more depth
- Connections made to previous visit

How does theory influence Learning Trajectory shape?

Everyday Experiences CT Programming



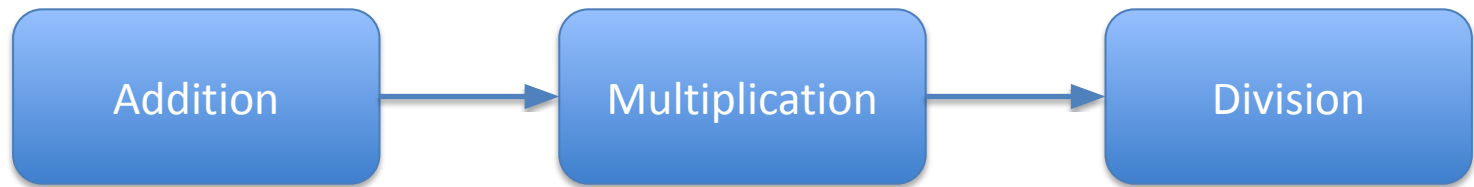
(d) Constructivism

Learning Trajectories

- Content, not teaching method
- Provide ***possible orderings*** for presenting material that builds upon itself
- Identifies points of understanding to focus on before going to next level

Let's try making an LT

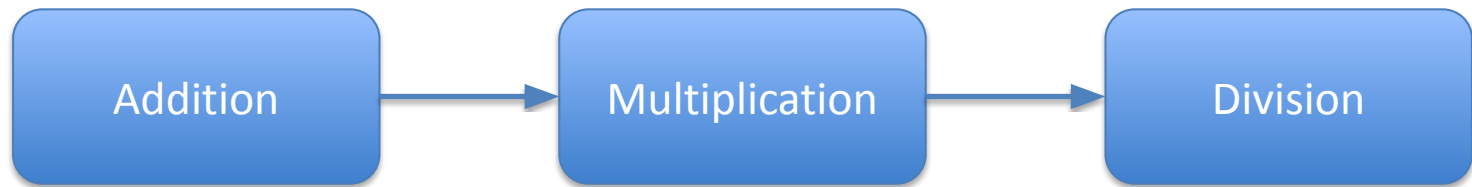
- Learning Goal (endpoint)
- Prior knowledge necessary / helpful



Is this useful?

Let's try making an LT

- Learning Goal (endpoint)
- Prior knowledge necessary / helpful



Is this useful?

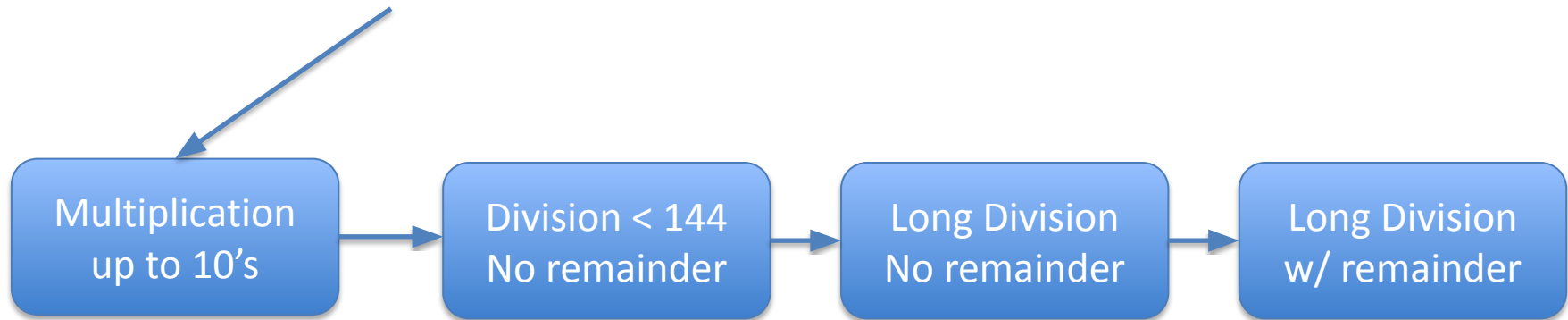
Too coarse-grained – “division” is not one learning goal

Too much content – won't teach this all in one activity

Potentially too easy – division (from products < 13) is memorization, not understanding

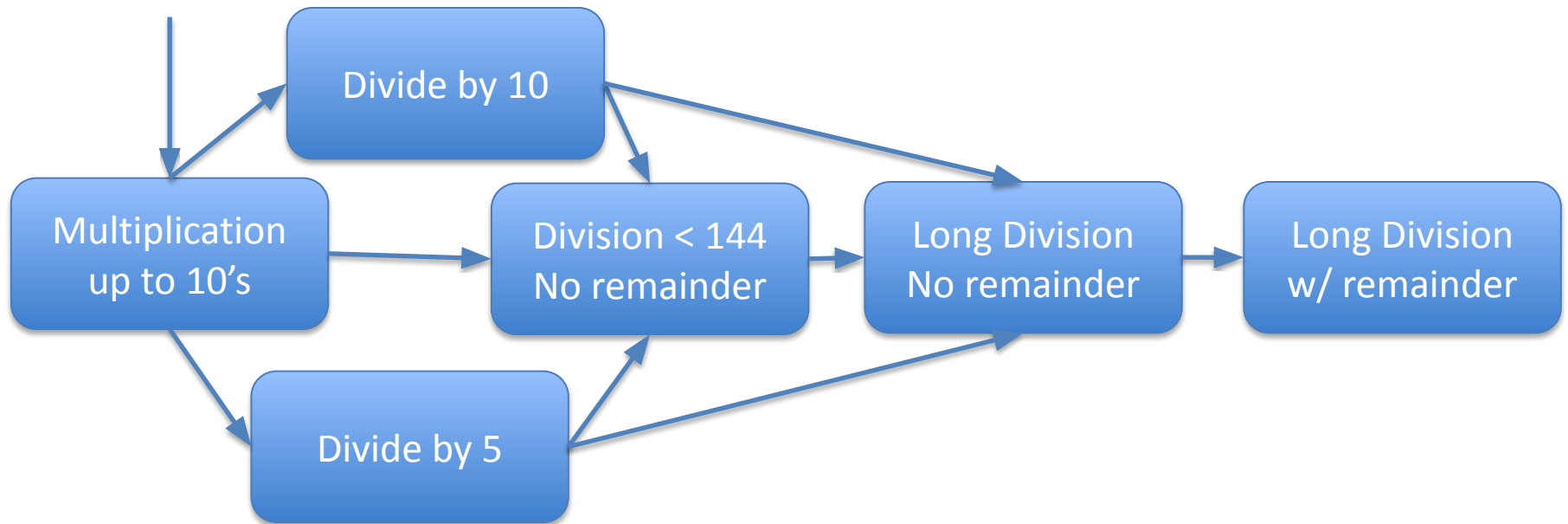
Stepwise Refinement – Break it Down!

Lower Anchor Point(s)
(what they already
know)



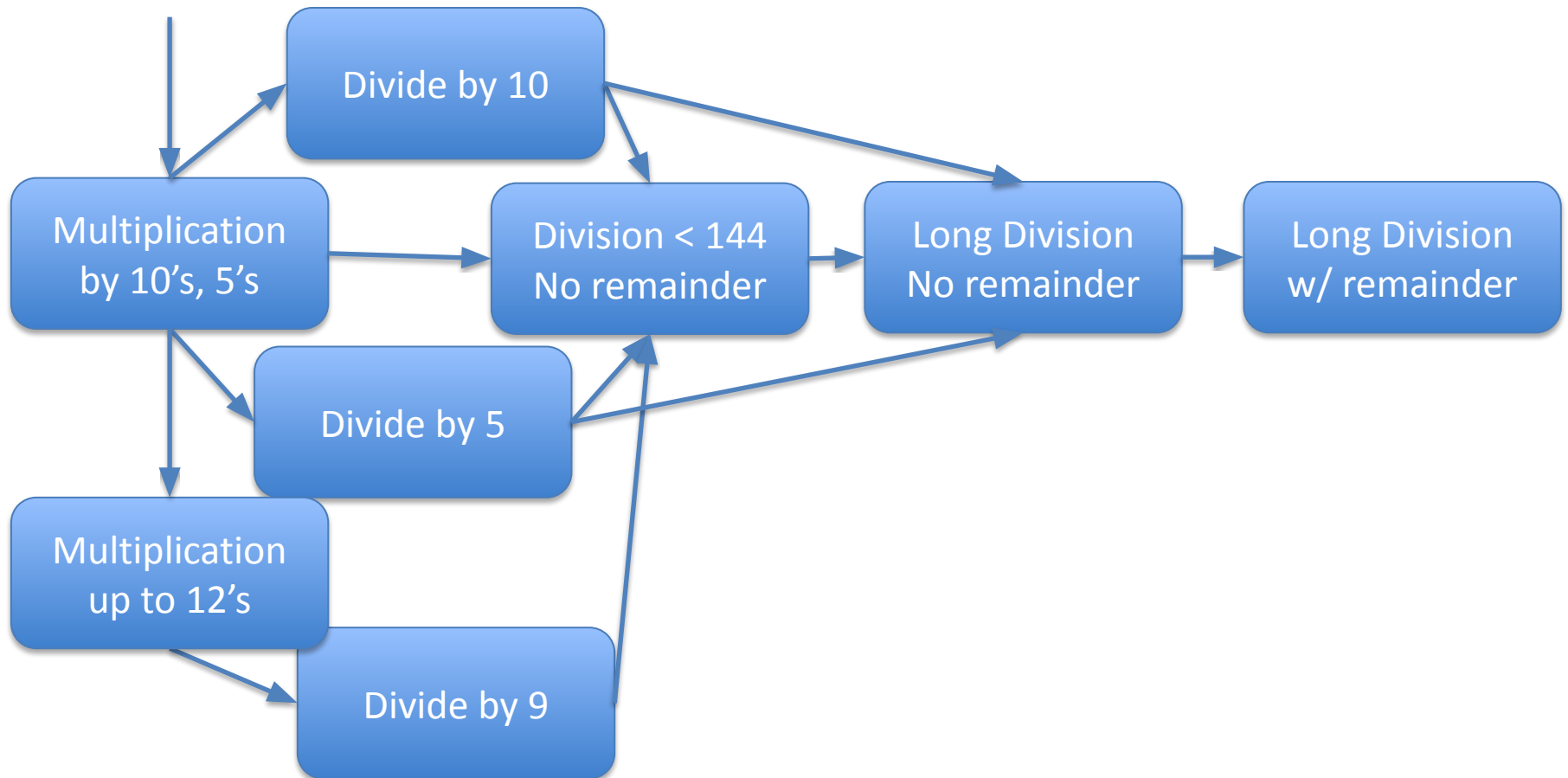
Stepwise Refinement – Break it Down!

Lower Anchor Point



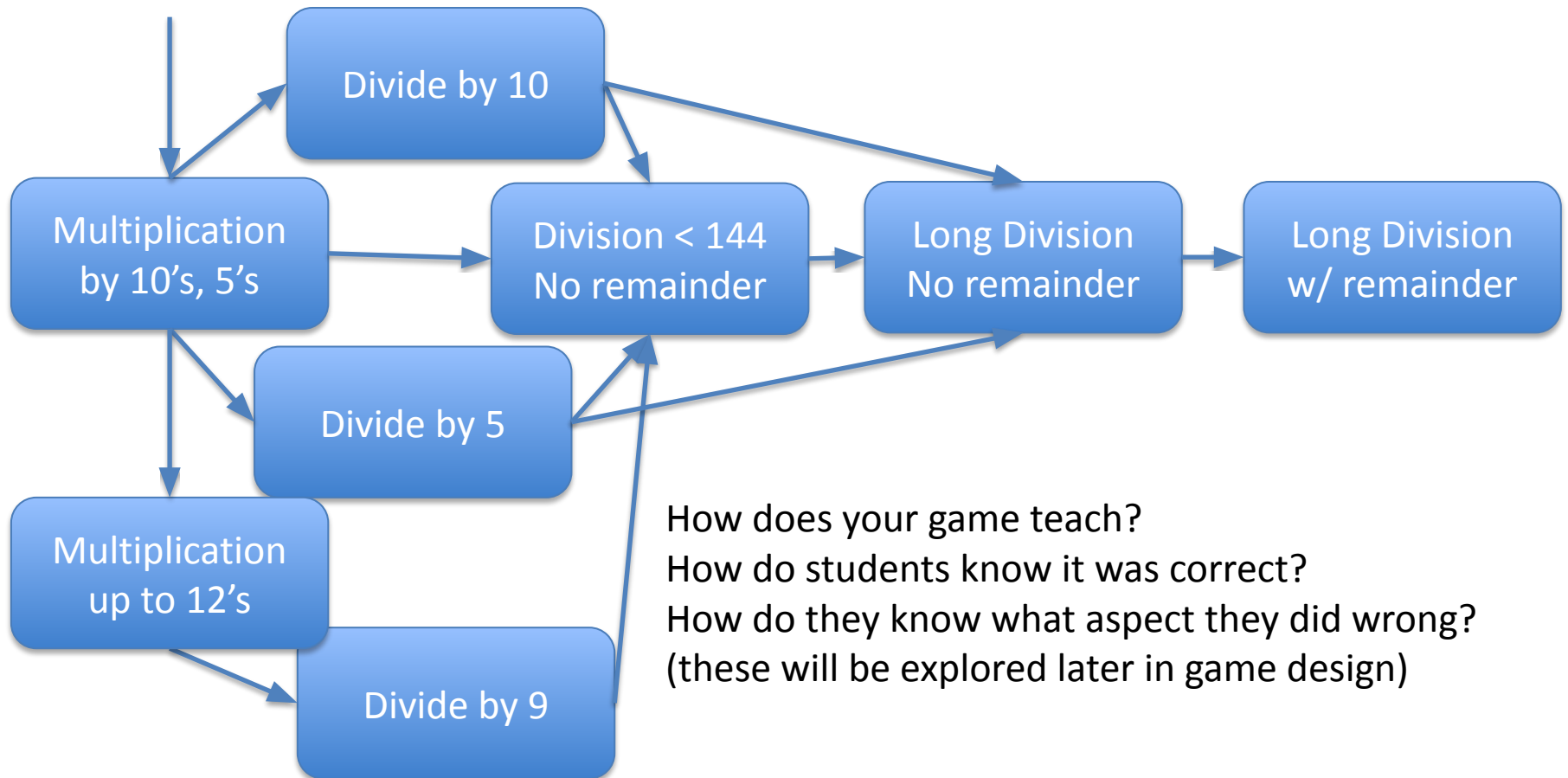
Stepwise Refinement – Break it Down!

Lower Anchor Point



Stepwise Refinement – Break it Down!

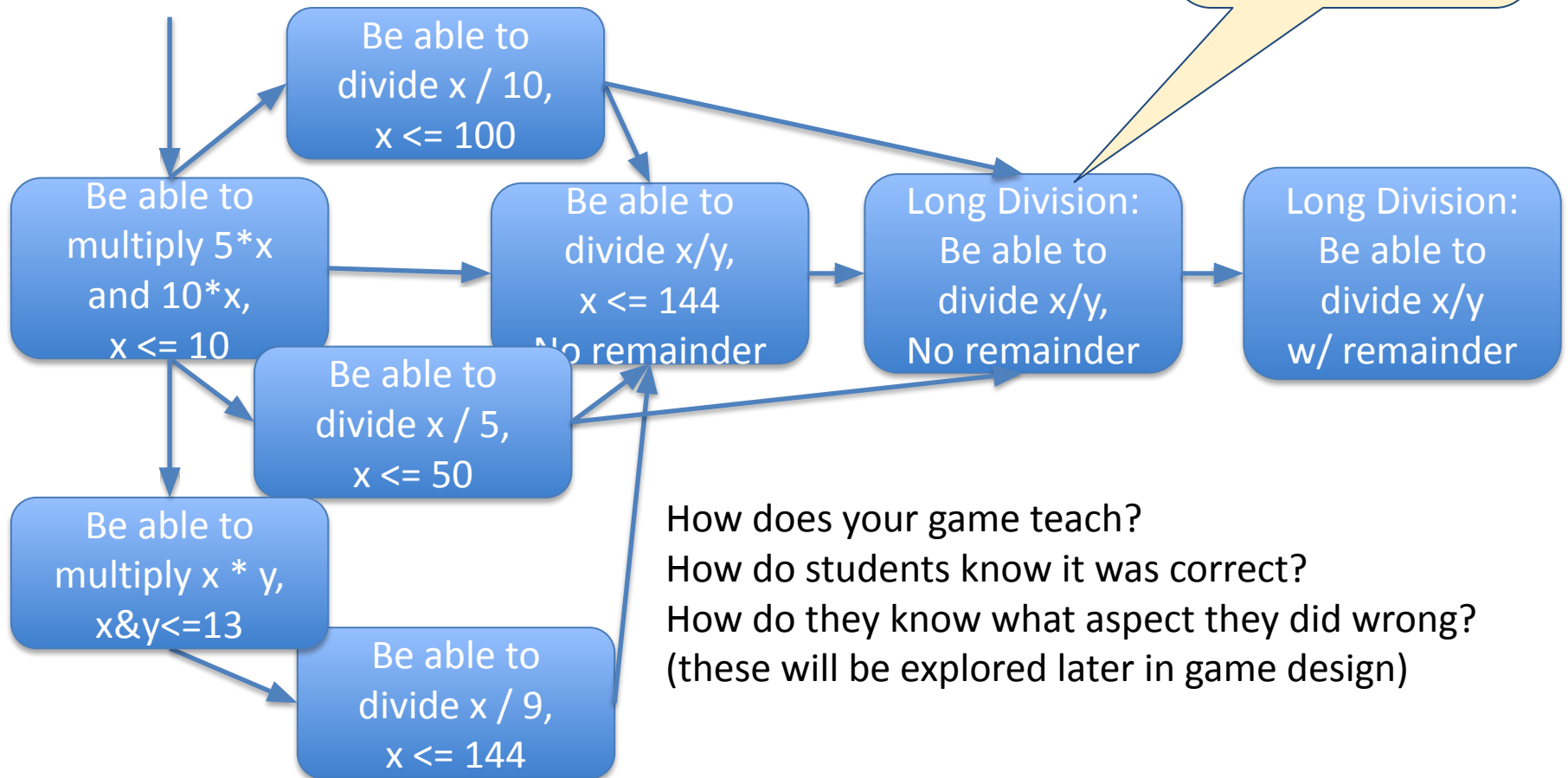
Lower Anchor Point



Stepwise Refinement – Break it Down!

These are all *skills* -
LT's can also have
knowledge goals

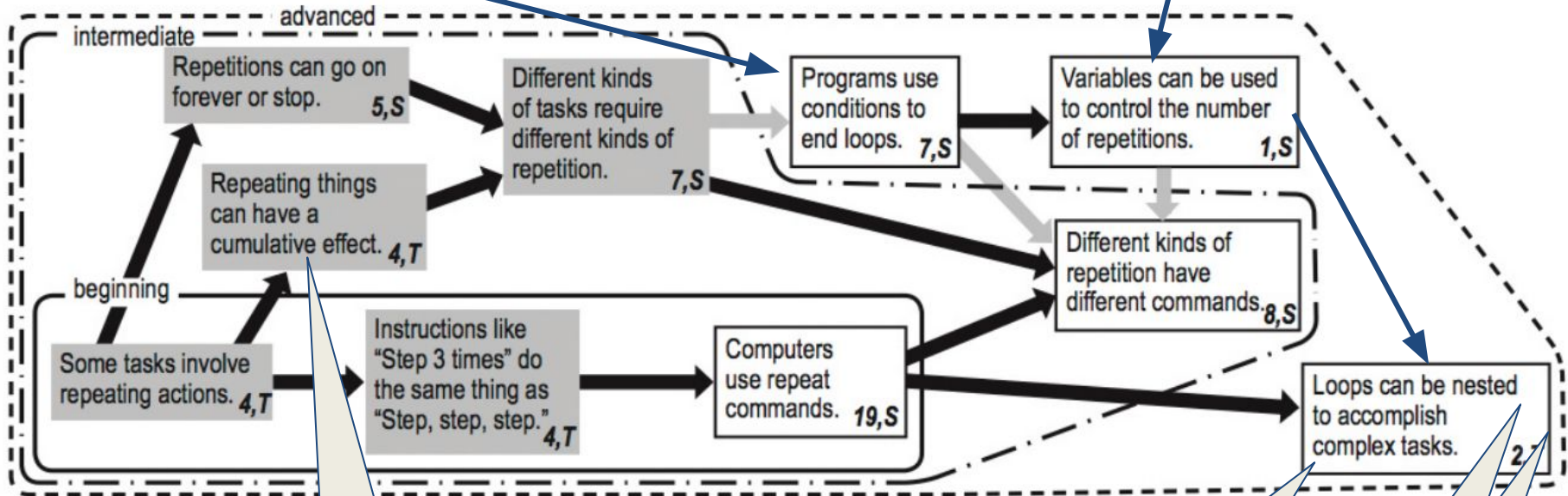
Lower Anchor Point



LT for Loops

Conditionals

Variables



Complexity (n vs n²)

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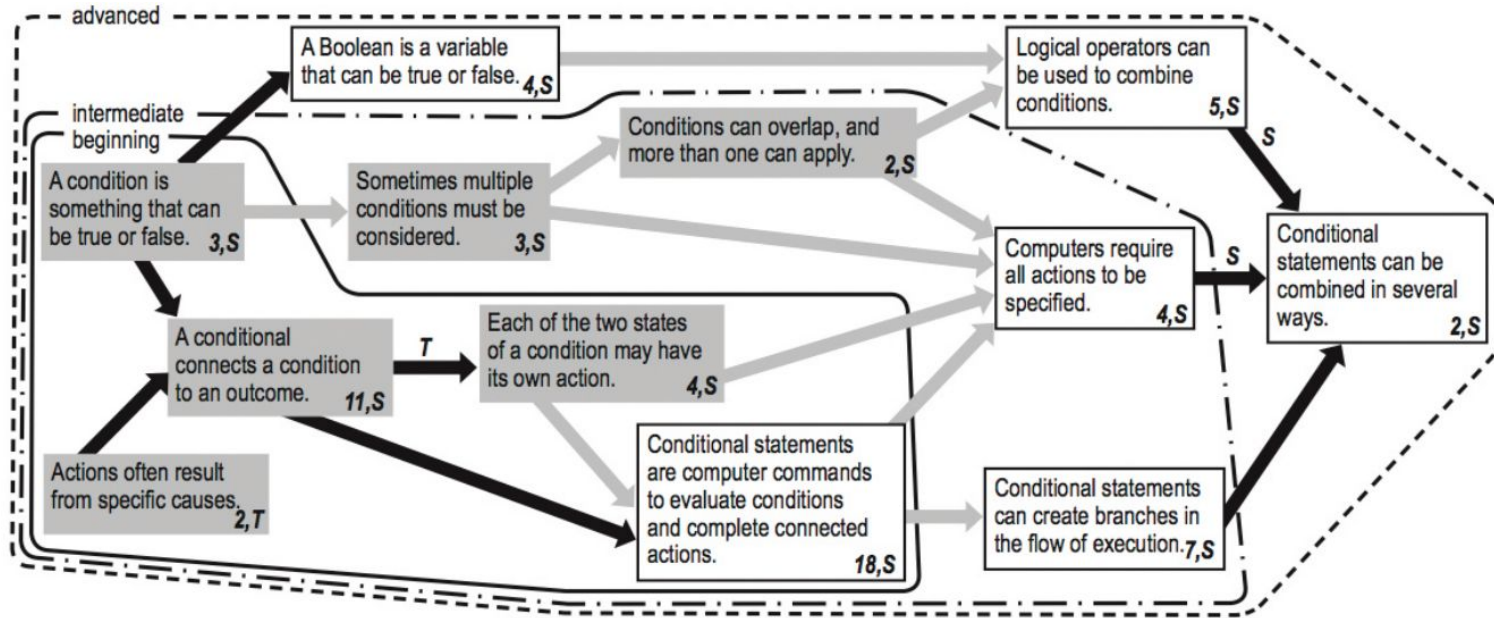
There is a specific order in which the loop will run

How could this be improved?

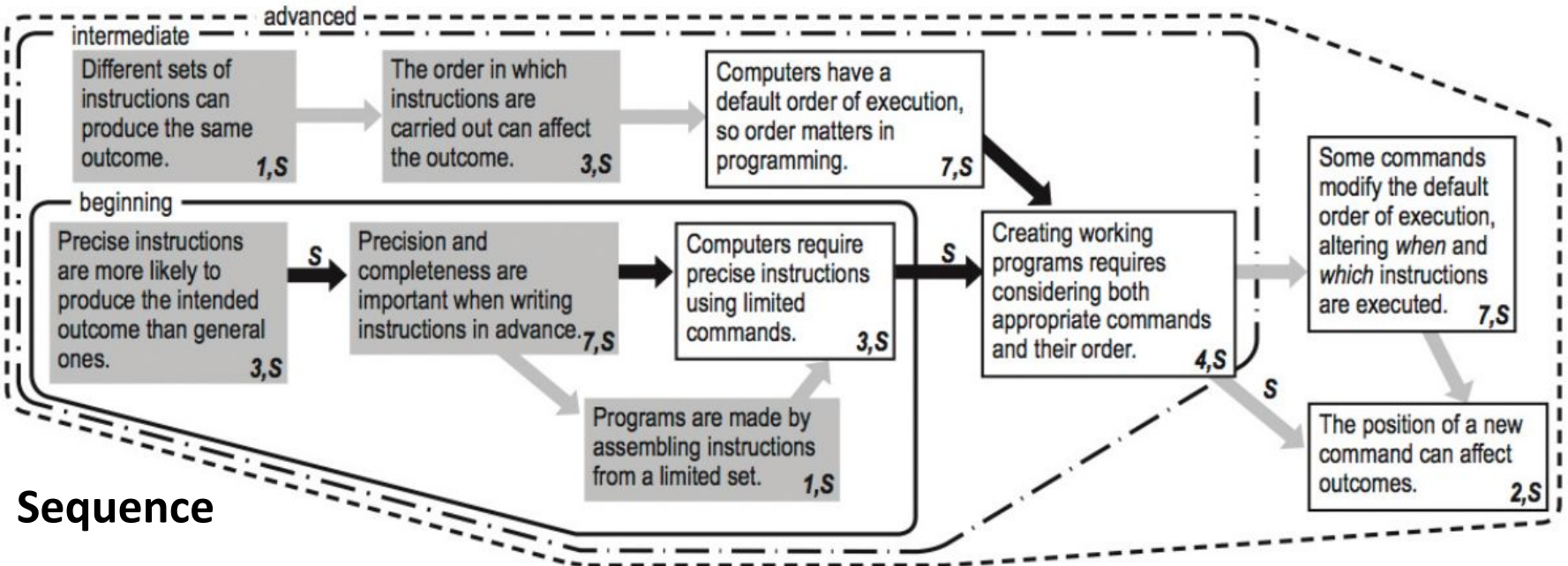
Create an LT for Variables

1. Define an end learning goal
2. Define intermediate goals
3. Define lower anchor points
4. Identify dependencies between them
5. Draw it with boxes and arrows

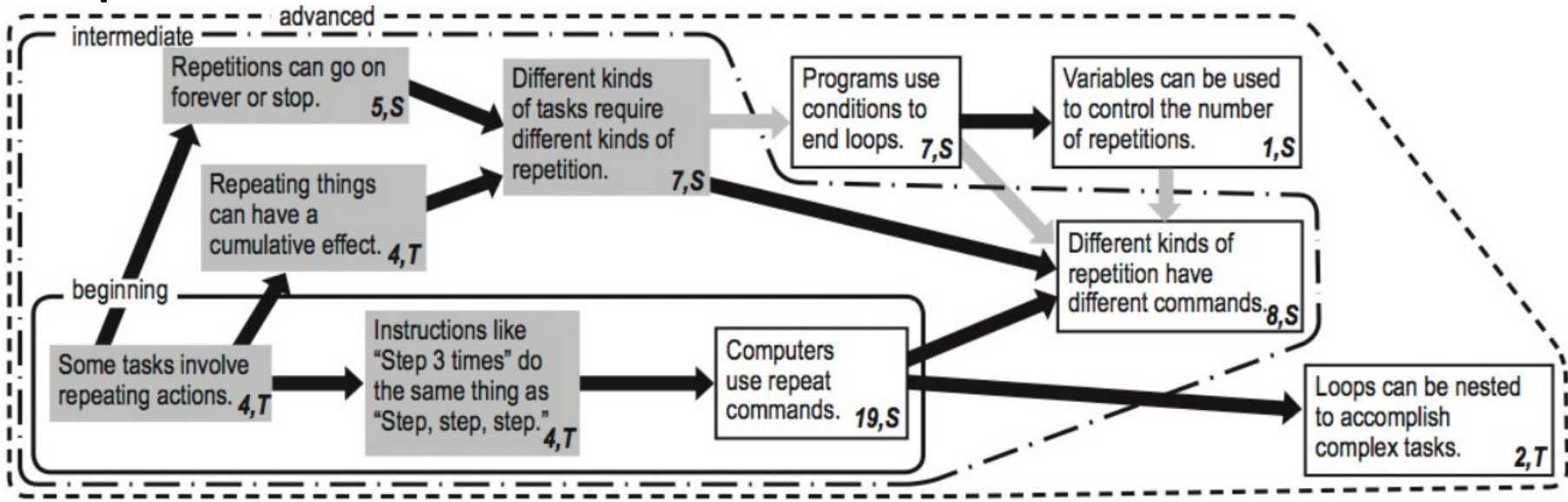
Conditionals



Variables



Loops



Breakout Group

Make a learning trajectory for practice (do not need to be held to it for your final project)

Focus is on the granularity of learning goals (not too large) and ordering them

Use online resources for inspiration for individual learning goals (textbooks or standards if it is academic, other learning materials for other subjects)

Project

- Groups of 2-3
- Choose a subject to teach
- Choose what level to teach (3rd – 9th grade)
 - Use to identify lower anchor points
- Main target must be different from yourself in some meaningful way (age, interests, opportunities, culture, language, etc.)

Content Attributes

- Cannot be memorization (e.g. flashcards)
- Cannot teach through “quiz”
- Must have a character that moves
 - Must interact with other objects on screen
- Must have multiple “scenes” (backgrounds)
 - Opening / welcome screen with multiple choices
 - Internal screen with mini-games

Project

- Design
 - Complete design
 - No resource constraints (time, \$)
- Implementation
 - Agreed-upon subset of full design
 - Reasonable to complete by end of quarter
 - Illustrates the design of the game and principles of course