

COGS 1: Spring 2019

Section G, Week 8

Professor Boyle	<u>mboyle@ucsd.edu</u>	Friday, 2-4 pm	CSB 130
Lauren	<u>lcurley@ucsd.edu</u>	Tuesday, 10-11 am	CSB 225
Lexi D.	<u>adalenco@ucsd.edu</u>	Tuesday, 12:30-1:45 pm	The Loft
Elena	<u>edreisba@ucsd.edu</u>	Thursday, 1-2 pm	CSB 114
Adrian	<u>ajm033@ucsd.edu</u>	Wednesday, 5-6 pm	CSB 114
Audrey	<u>aberardi@ucsd.edu</u>	Tuesday, 4-5 pm	CSB 114
Devansh	<u>d4agarwa@ucsd.edu</u>	Monday, 4-5 pm	CSB 114
Lori	<u>rol044@ucsd.edu</u>	Monday, 10-11 am	CSB 114
Lexi F.	<u>adfrankl@ucsd.edu</u>	Thursday, 4-5 pm	CSB 114

Important Information

- **Week 9 Quiz**

- ONLINE: 5/31 (Friday) - 6/2 (Sunday), time is STILL LIMITED but you can take it during whatever time you need
- Make sure to check TritonEd for exact times - give yourself **lots** of extra time to allow for internet/technical issues
- Sections next week are optional but we will still be reviewing for the quiz

- **EC Reading Quiz**

- Based on reading for Dr. Hollan's lecture: "*Activity Enriched Computing*"
- Available on TritonEd from Wednesday May 29 @ 4pm - Thursday May 30 @ 10:00 am

Last Week's Topics

- Lecture 12 | Dr. Cottrell: How Does the Brain Make the Mind?

Only **one**
lecture for this
week!



Lecture 12 | Review Questions (1 of 2)

Vote!!

1. What are the methods that could be used unravel out how the brain works?
2. Why do we need models/modeling in cognitive science? What are the axioms of cognitive science?
3. What are the motivations to study neural nets?
4. How do humans compute? Illustrate with examples.
5. How do biological neural networks differ from machine neural networks?

Lecture 12 | Review Questions (2 of 2)

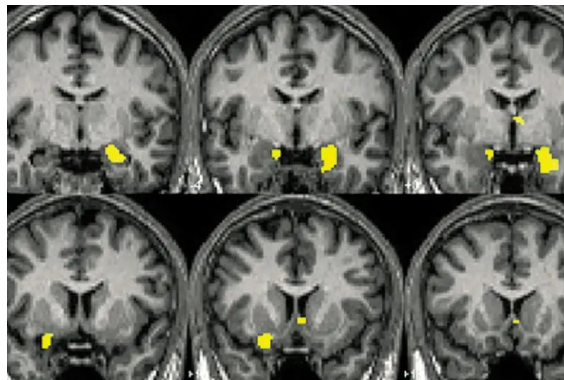
Vote!!

6. What does a good cognitive model look like (or how does Dr. Cottrell like to build cognitive models)? How does the neural net for reading work?
7. What is a perceptron?
8. Explain the basics of the training process of a perceptron.
9. What type of problem can a perceptron solve?
10. Describe the structure of multi-layer neural nets.

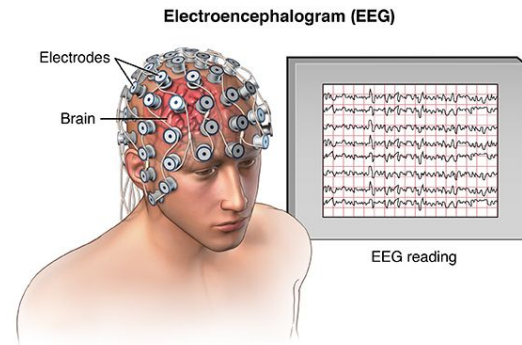
1. What are the methods that could be used to unravel how the brain works?

Making Measurements

- **Behavior** - input vs. output
- **Brain waves** - EEG
- **Brain activation** - MEG / fMRI
- **Neuron recordings**
 - Animals - record while animal performs some task
 - Humans - during surgery for people with epilepsy



Measurements => Models



2. Why do we need models/modeling in cognitive science?



MODELS

UNDERSTANDING

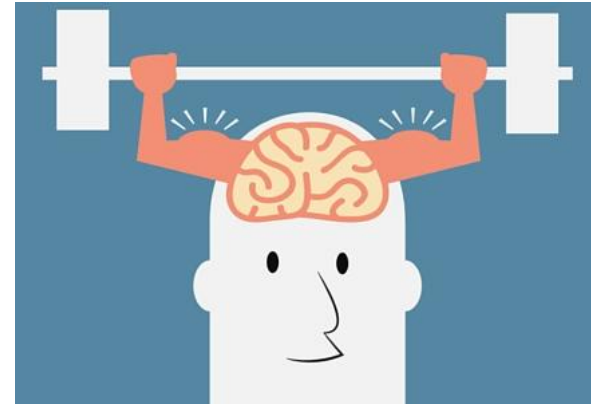
Building models **based on data** from measurements \Rightarrow allow us to see brain “in action”

All
Ques.

2. What are the axioms of cognitive science?

Axioms of Cognitive Science

1. **The mind is what the brain does**
 - There is no “spooky stuff”
2. **The kind of computation the brain does is *probabilistic***
 - Love at first sight is a computation
3. **What the brain does, i.e., *thinking*, is a kind of computation**
 - To deal with the uncertain nature of the world
 - Probability is the “language of thought”

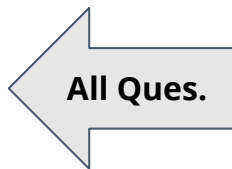
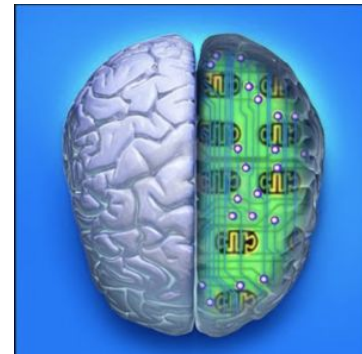
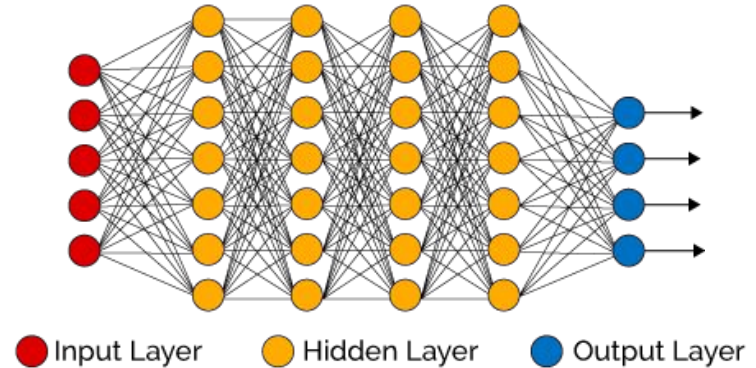


3. What are the motivations to study neural nets?

Humans vs. Machines

- **Architectural Differences** - We are great at parallel computing.
- **Train Neural Nets** - “Brain like” models that can do things like recognize faces, interpret sentences, move limbs, play games, drive cars, etc.
- **Deep Networks** - Multi-layered networks similar to our brains.

Deep Learning Neural Network



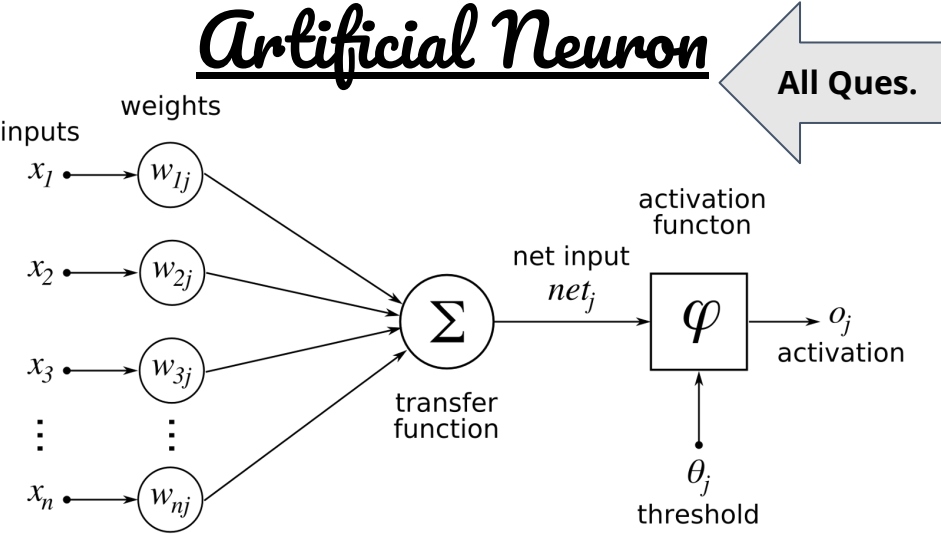
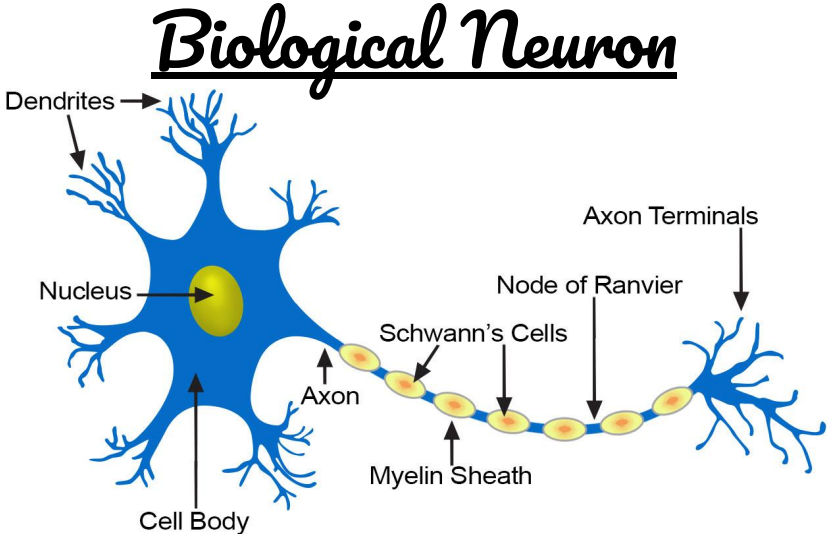
4. How do humans compute? Illustrate with examples.

Combining Information with Context

- **Understand sentences** - Apply semantics (meanings) and syntax (grammar).
- **Disambiguate words** - Integrate constraints from various sources.
- **Read ambiguous letters** - Context influences perception.
- **Recognize faces** - We like faces that are right side up → Thatcher Effect.



5. How do biological neural networks differ from machine neural networks?



- **Typical neurons** - Consist of dendrites (input), soma (cell body) and axon (output).
- **Neural networks** - Comprised of inputs (from outside world/other units), connection strengths (weights), internal potential and output.

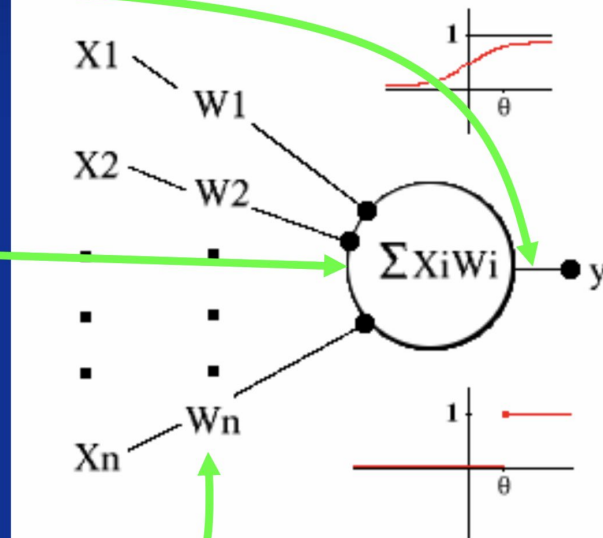
5. How do biological neural networks differ from machine neural networks?

A Model "Neuron"

- Axon (output)

- Cell body (soma)

- Dendrites (input)

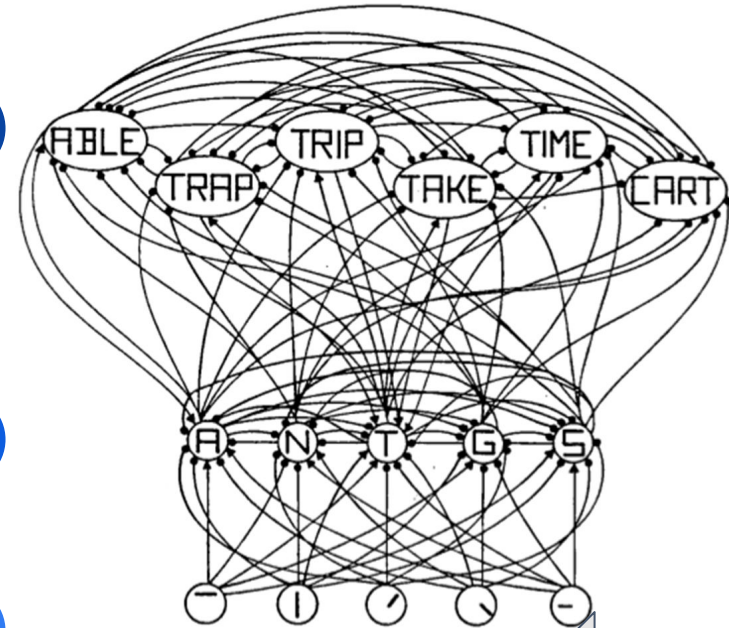
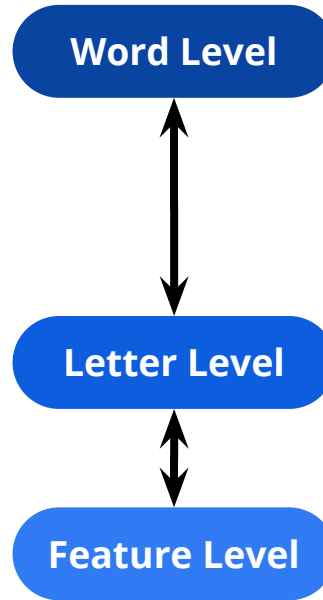


All Ques.

6. What does a good cognitive model look like (or how does Dr. Cottrell like to build cognitive models)? How does the neural net for reading work?

Reading from Print

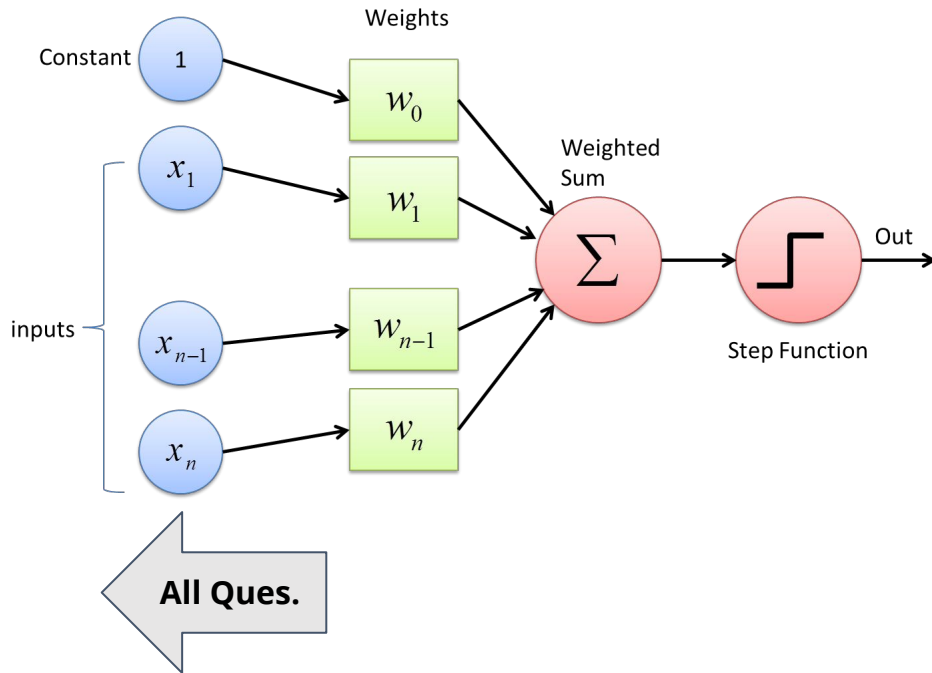
- Interactive activation model allows for **multidirectional feedback**. Lines influence letters which in turn influence words, and back again.
- Accounts for the “**word superiority effect**” in a “Winner Take All” network.



All Ques.

7. What is a perceptron?

Mathematical Model of a Neuron

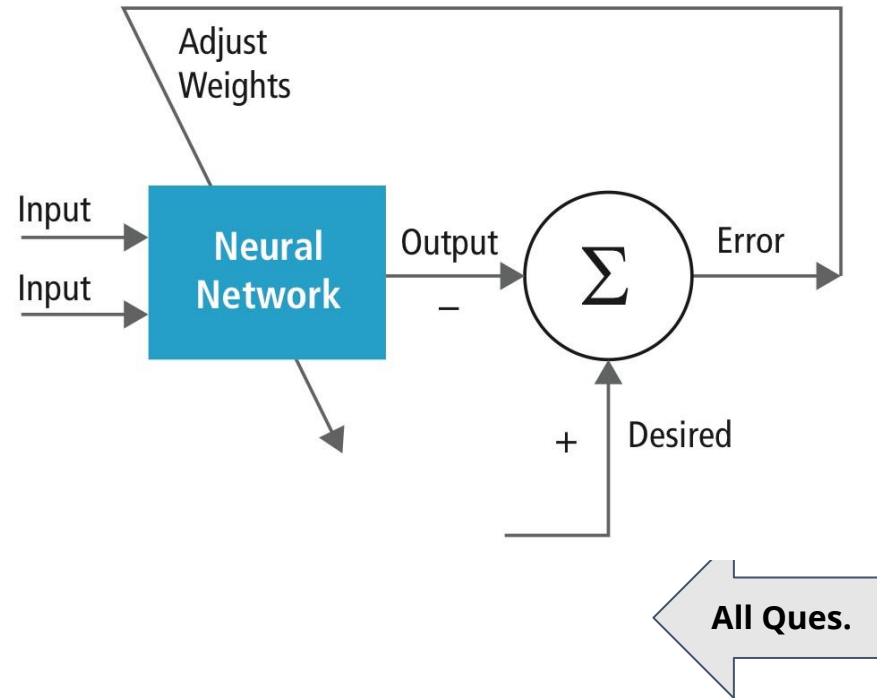


- Consists of:
 - Weights
 - Summation processor
 - Activation function
 - Threshold processor
- All the inputs are individually weighted, added together and passed into the activation function.

8. Explain the basics of the training process of a perceptron.

Learning Through Mistakes

- Input vectors from a training set are presented to the perceptron one after the other and weights are modified as per errors.
- When an entire pass through all of the input training vectors is completed without an error, the perceptron has learnt.

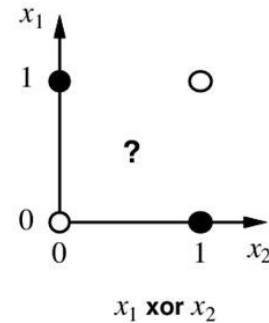
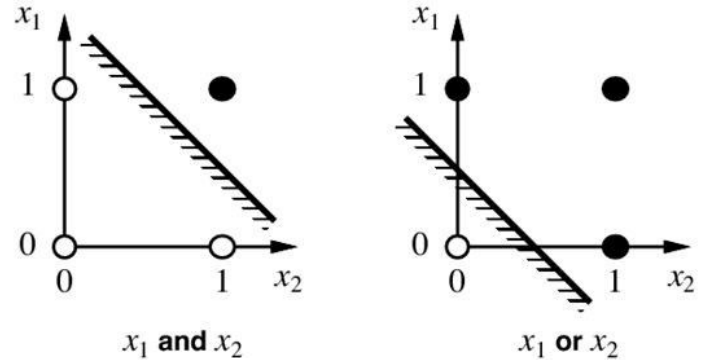


All Ques.

9. What type of problem can a perceptron solve?

Limitations of Perceptrons

- A perceptron adds all the inputs and separates them into 2 categories, those that cause it to fire and those that don't by drawing the line.
- Such inputs are *linearly separable*. If the vectors are not linearly separable, learning will never reach a point where all vectors are classified properly. E.g. Boolean XOR problem.

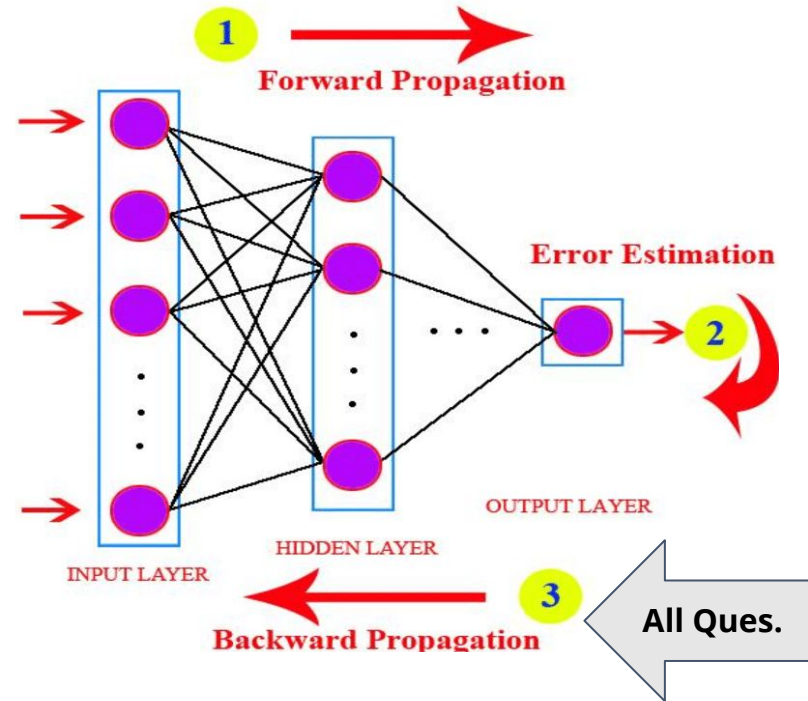


All Ques.

10. Describe the structure of multi-layer neural nets.

Train Hidden Layer → Back Propagation

- Each input from the input layer is fed up to each node in the hidden layer, and from there to each node on the output layer.
- To train this network we need to tune **not only** the weights between the output layer and the hidden layer **but also** the weights between the hidden layer and the input layer.



Quiz Time!

- No talking, signaling, or communicating of any kind.
- Put away your books, notes, computers, phones, etc.
- Pen or pencil is okay (just make sure it's a black pen and you press hard with a pencil).
- Write your name in the "Name" box, write and circle in your PID, and sign the academic integrity agreement.
- Bubble in this section
- Please have your student ID out when you turn in your quiz!

Write and circle
in your PID

Write down your name here

UC SAN DIEGO – DEPARTMENT OF COGNITIVE SCIENCE



STUDENT PID NUMBER									
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Last NAME		First NAME					
COURSE NUMBER							
COGS 1							
SPRING 2019							
Dr. Mary ET Boyle							
Quiz A							
April 9-12, 2019							
Quiz VERSION							
A	B	C	D	E	F	G	H
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Section you are taking this quiz:
Please Bubble only one!

- [1] ① Monday @ 9 Lexi D.
- [2] ② Monday @ 4 Elena
- [3] ③ Wednesday @ 2 Adrian
- [4] ④ Wednesday @ 3 Audrey
- [5] ⑤ Wednesday @ 5 Devansh
- [6] ⑥ Friday @ 11 Lori
- [7] ⑦ Friday @ 12 Elena
- [8] ⑧ Friday @ 1 Lexi F.

Bubble in the
current section

Quiz will not be graded without
Academic Integrity Signature.

Sign and
date here



ACADEMIC INTEGRITY	
<p>By taking this quiz, you agree that you will follow ALL UCSD ACADEMIC INTEGRITY policies. It is YOUR responsibility to know and understand all of the policies. Failure to follow all UCSD Academic Integrity policies could result in expulsion from UCSD.</p> <p>DO NOT DISCUSS THIS QUIZ CONTENTS WITH FELLOW STUDENTS!!!</p>	
Signature _____	Date _____
Your signature above certifies that you <i>will follow</i> and that you know that you will suffer the consequence for ANY academic integrity violation.	

YOUR ANSWERS GO HERE

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Bubble in the
answers