

COMPUTER SCIENCE FOR ALL

Create, Compute, & Community Day!



Computer Science Activity Pack 6-8

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A Day of Computer Science!

This is a recommended schedule to follow when doing a full day of computer science. If activities do not take the full hour, we recommend taking a movement break such as GoNoodle (gonoodle.com) instead of moving to the next activity. Shift the day around based on your needs or recommendations by your school.

Recommended Schedule	
9 am - 10 am	Robot Zine
10 am - 11 am	Animate a Memory
11 am - 12 pm	Behind a Web Page
12 pm - 1 pm	Computer Science Lunch Break: tinyurl.com/PBJProgram
1 pm - 2 pm	Computer Science At Home
2 pm - 3 pm	Drawing with Code

Other Grade Band Activities

Above are the recommended activities that you can try based on your grade level. Feel free to challenge yourself with activities from other grades as well by looking at our full activity pack: [tinyurl.com/CS4AllCSActivityPack!](http://tinyurl.com/CS4AllCSActivityPack)

Middle School Activities

Robot Zine

Type: Unplugged

With advances in Artificial Intelligence (AI), it is more important than ever that we consider how humans and computers will interact. How do you want the robots of the future to behave towards you and others?

Vocabulary

- **Robot** - A machine capable of carrying out complex tasks automatically
- **Zine** - A self-made publication that might look like a small handmade magazine with text, illustrations, and cutout images

More on Computer Science concepts at blueprint.cs4all.nyc/concepts

Materials needed

- Large paper or whiteboard for brainstorming
- Scissors
- Markers, crayons, pencils
- Construction paper and glue sticks
- Optional: magazines for cutting out images/text
- Optional: sticky notes
- How to fold a zine: zineopolis.blogspot.com/p/h.html
- Video tutorial for folding a zine: tinyurl.com/ZineVideo

Activity

- For this activity, you will create a “robot zine.” In this zine you will:
 - Identify what a robot is
 - Propose a new robot you wish existed or might invent someday
 - Include a code of conduct that you and your robot will follow
- First, read this article and watch the video:
 - What is a Robot?: wired.com/story/what-is-a-robot

- On the first page of your zine, explain what a robot is in your own words
 - Add pictures and color too!
 - Make sure to highlight or bold what you consider key words
- On the next pages of your zine, add some surprising or interesting examples of robots that you can find
 - Describe and/or draw them!
 - Make note of what they are used for and how they make human's lives easier/better
- On the next page of your zine, add a robot you wish existed
 - Describe and/or draw it!
 - You can look at these scenarios for inspiration: tinyurl.com/SpringBreakRobots
 - What robots do you think could help people get through the current predicament?
- On your last page, add a code of conduct
 - Think of a code of conduct that your school, sport, or club follows
 - These will set rules and responsibilities for both you and your robot
 - What rules do you think your robot should follow?
 - What rules do you think all robots should follow?
 - What rules do you think people who make robots should follow?
- Share your zine with your friends and family
 - Ask them what robot they wish existed
 - Make a second issue of your zine with other robots you or your friends and family come up with

Continue Your Learning

- The Ethical Robot: tinyurl.com/TheEthicalRobot

Behind a Web Page

Type: Unplugged

Hypertext Markup Language (HTML) is the standard way to publish information or applications on the Internet. In this activity, you will identify what part of an HTML document will be displayed on a web page and explore basic HTML tags.

Vocabulary

- **Decomposition** - Breaking a problem down into smaller pieces
- **Pattern Recognition** - Finding similarities between things
- **Markup** - The code that explains how a web page should be structured (e.g. HTML)

More on Computer Science concepts at blueprint.cs4all.nyc/concepts

Materials needed

- Print the Web page example: tinyurl.com/WebPageExample (screenshot below)

The Pros and Cons of Social Networking

A look at the ups and downs of being so digitally connected to people

Lifewire, by Elise Moreau *Updated November 06, 2017*

Social networking has changed the way we communicate, do business, get our daily news fix and so much more. But is it really all it's cracked up to be?

- Print the HTML code document: tinyurl.com/HTMLCodeExample (screenshot below)

```

1 <!DOCTYPE html>
2
3 <html>
4   <head>
5     <title>Lifewire</title>
6   </head>
7
8   <body>
9     <h1>The Pros and Cons of Social Networking</h1>
10    <h2>A look at the ups and downs of being so digitally connected to people</h2>
11    <h3>Lifewire, by Elise Moreau <i>Updated November 06, 2017</i></h3>
12    <p>Social networking has changed the way we communicate, do business, get our daily
    news fix and so much more. But is it really all it's cracked up to be?</p>

```

Activity

1. Look over the *Web page on the web* document, which is an example of a web page, and the *HTML code* document, which is the HTML code for the example web page
2. Find and highlight the content you see on the web page on the printed HTML document
3. Do you notice which tags contain the highlighted content?
 - Don't worry about what each tag does right now, just which tags you see
4. Some important information to know:
 - **Web page:** A web page is what is displayed by a web browser
 - **HTML document:** An HTML document contains the content that the web browser turns into a web page
 - **HTML tags:** HTML tags determine how the browser should display the content such as paragraphs, bullet points or images. HTML tags are mostly paired, opening and closing tags (i.e. `<p>..</p>`, `<h1>..</h1>`)
5. Which paired HTML tags do you see? What does the content of the web page look like for each tag pair? What do you think each tag pair's function is?
6. If you have a computer with access to the internet, open up codepen.io
 - Recreate the HTML document there and try changing content and tags!
 - Make your own website that can act as your resume or a website that shows thanks for all of the hard work that hospitals are doing!
7. Share what you learned and/or created with a friend or family member!

Continue Your Learning

- Khan Academy's Intro to HTML: tinyurl.com/KhanAcademyHTML
- HTML Introduction: w3schools.com/html/html_intro.asp
- HTML tags references: w3schools.com/tags/default.asp

Drawing with Code

Type: Plugged

There are many different programming languages, and each come with their own strengths. P5.js is one of the Javascript libraries that has a full set of drawing functions. In this activity, you will explore drawing basic shapes like a square, rectangle and circle by coding with p5.js.

Vocabulary

- **Decomposition** - Breaking a problem down into smaller pieces
- **Algorithm Design** - Creating clear instructions that can be executed without confusion
- **Programming Languages** - Different languages have different applications and require different amounts of prior knowledge

More on Computer Science concepts at blueprint.cs4all.nyc/concepts

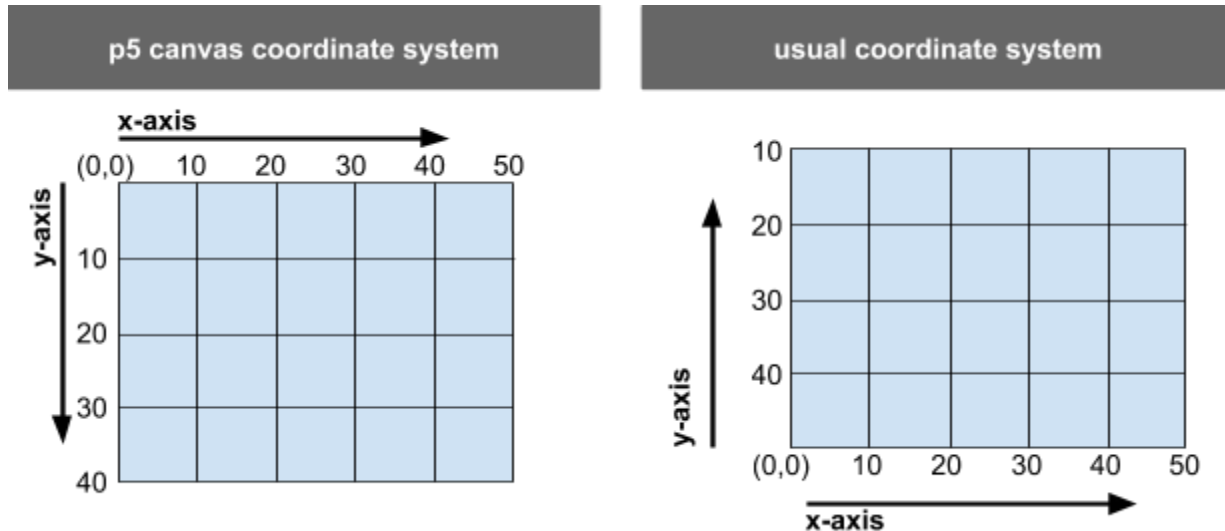
Materials needed

- Computer
- Access to the p5.js online editor: editor.p5js.org

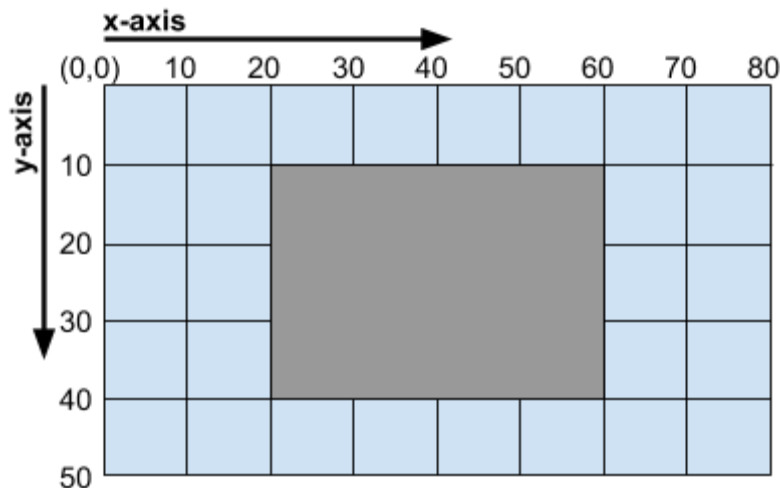
Activity

1. **Computer and programming languages:** To tell a computer to complete tasks, we need to give it clear instructions using a language that a computer understands. In this activity, to tell a computer to draw shapes, we'll be using p5.js
2. **Canvas:** Before drawing anything, first p5.js requires you to create a canvas on your screen by setting up its width and height. This canvas is where your shapes will be displayed and it has a coordinate system so that a computer knows where and what to display on the canvas

3. **P5 canvas coordinate system:** Note that the p5 canvas coordinate system is different from any other usual coordinate system. See the image below:



4. **Drawing a rectangle:** See an example below. To tell a computer to draw the rectangle from the example, what information do you think a computer needs to know?



- **Width of the rectangle:** In this example, it will be 40
- **Height of the rectangle:** In this example it will be 30
- **Location of the rectangle on the canvas:** with p5.js, to determine the location of a rectangle, you need to let a computer know the coordinates of the upper-left corner. In this example, it will be (20, 10)

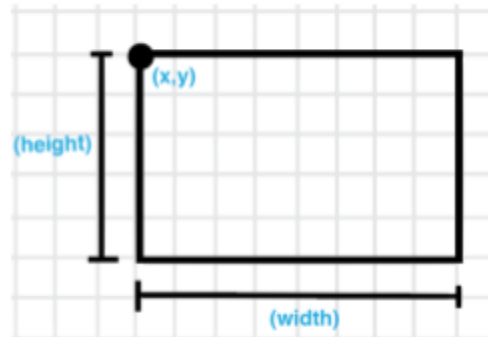
5. **p5.js syntax:** In p5.js, these pieces of information are used in the form shown below:

`rect(x, y, width, height);`

↑
(x, y) of the upper-left corner of a rectangle

To draw the rectangle in the example, syntax will look like this:

`rect(20, 10, 40, 30);`



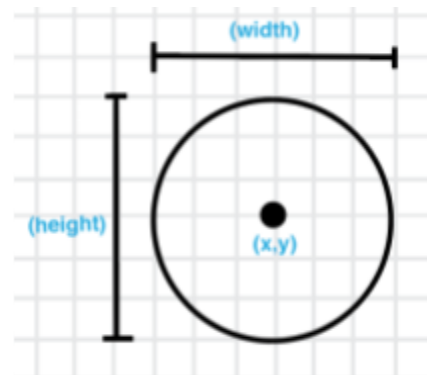
6. **p5.js online editor:** Open the online editor, editor.p5js.org, and draw the example rectangle! Write the syntax for the rectangle like the image below, then click the play button at the top-left corner:



7. **Drawing an ellipse (oval):**

`ellipse(x, y, width, height);`

↑
(x, y) of the center of an ellipse

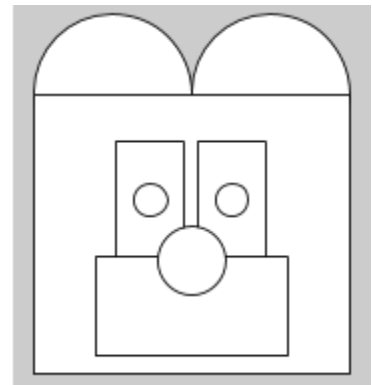
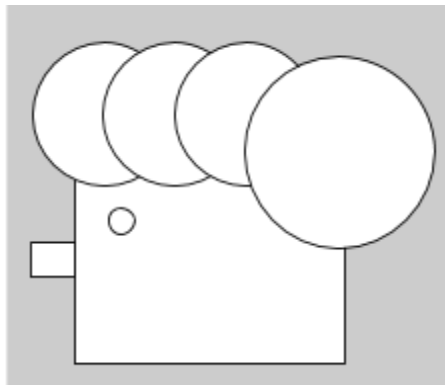
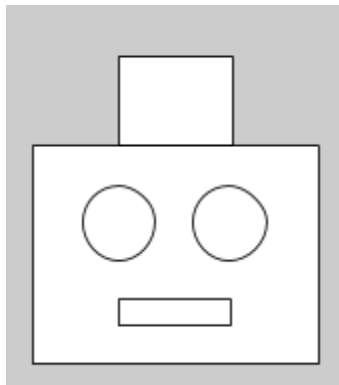


8. **Drawing order:** When drawing multiple shapes, the shape that you draw first will be drawn first, then the second one, then the third one and so on. If there is any overlap, the first shape will be below the second one, the second one will be below the third one, and so on

sketch.js*	Preview
<pre> 1 function setup() { 2 createCanvas(400, 250); 3 background(220); 4 } 5 6 function draw() { 7 // This is where syntaxes live to draw shapes 8 rect(20, 10, 40, 30); // #1 rectangle 9 rect(30, 20, 40, 30); // #2 rectangle 10 rect(40, 30, 40, 30); // #3 rectangle 11 12 }</pre>	

9. **Challenges!** Here are some drawing challenges with rectangles and ellipses.

- We recommend using grid paper to sketch out the drawing, it will help you figure out the location of each shape



10. What else can you draw? Can you make an image that you can print out and put on your door to show your appreciation for those working on the front lines?

Continue Your Learning

- hello p5.js video: hello.p5js.org
- p5.js reference: p5js.org/reference



Animate A Memory

PLEASE READ!

Note to Parent(s) & Teachers:

For this activity, students should begin by [interviewing a friend or family member](#) (page 35), or jot down ideas about a memory that they have with a friend or family member.

For Students in Grades K-2:

After the interview students should use the [PBS Kids Design Squad Prototype Template](#) (page 39) to prototype their project (brainstorm what they will include in it). To animate their interview, students can use PBS Kids Design Squad: pbskids.org/designsquad/projects.

For Students in Grades 3+:

After the interview, students should use the [Scratch Prototype Template](#) (page 36) to prototype their project (brainstorm what they will include in it). To animate their interview, students can use Scratch: scratch.mit.edu. Students are new to programming with Scratch should try one of their tutorials first: scratch.mit.edu/ideas.

Alternate animation options:

- Code.org Labs: studio.code.org/projects/public
- Scratch Jr.: scratchjr.org/about/info

Name: _____

Date: _____

Animate A Memory - Family/Friend Interview

Task: Interview a friend or family member so you can get ideas for a digital story created with Scratch or PBS Kids Design Squad.

Directions: Interview a family member about their best memory from when they were in school, or interview a friend about their best memory from a summer! Type or write their responses under the questions below.

- 1) Who were you with?

 - 2) What were you doing?

 - 3) Where were you?

 - 4) Why were you there?

 - 5) When did this happen?

 - 6) How were you feeling?
-

Name: _____

Date: _____

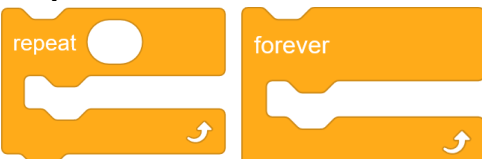

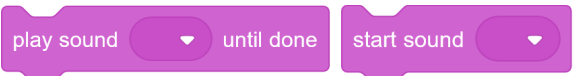
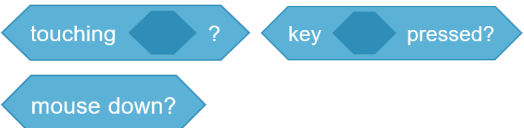
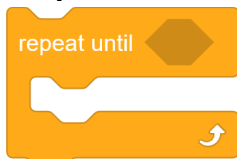

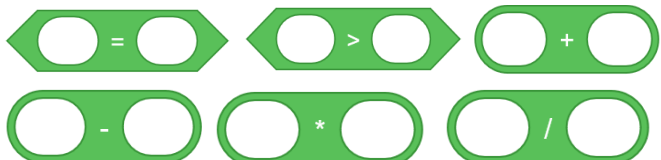
Animate A Memory - Scratch Prototype Template

Task: Write down your ideas for your Scratch project.

Directions: Use this space to plan your design!

Required Scratch Elements (see below for specific blocks)

- 3 different sprites (all must have movement)
- 3 different backgrounds (Draw your own, choose from the library, or upload an image)
- Event blocks
- Loops and Conditionals blocks
- 1 "Sound" block
- 2 "Sensing and Operator" blocks
- Directions for the project using the following pages as guidelines

<p>Loops</p>  <p>Conditional Blocks</p>  <p>Sound</p>  <p>Sensing</p> 	<p>Loop + Conditional Block</p>  <p>Event Blocks</p>  <p>Operators</p> 
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Project Type

- movie animation
- interactive story

Project Description / Plot - How will a user interact with your project?

Storyboard Scenes - Draw and write what happens in your project as someone uses it.

What happens first?	What happens next?	
<hr/> <hr/> <hr/> <hr/>	<hr/> <hr/> <hr/> <hr/>	<hr/> <hr/> <hr/> <hr/>
		Project End
<hr/> <hr/> <hr/> <hr/>	<hr/> <hr/> <hr/> <hr/>	<hr/> <hr/> <hr/> <hr/>

Sprites / Characters

Name:	Name:	Name:
What will this sprite do?	What will this sprite do?	What will this sprite do?
Blocks Needed:	Blocks Needed:	Blocks Needed:
Will this sprite be shown or hidden at the project start?	Will this sprite be shown or hidden at the project start?	Will this sprite be shown or hidden at the project start?

Background Images You Will Need:

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What will the backdrop be at the start of the project?

When will the backdrop change?

Sounds / Sound Effects You Will Need:

--	--

Name: _____

Date: _____

Animate A Memory - PBS Kids Design Squad Prototype Template

Task: Write down your ideas for your PBS Kids Design Square project.

Directions: Use this space to plan your design!

Who will be in the digital story?	Where does the memory take place?	When did this happen?
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Computer Science At Home Activities

There are many Computer Science (CS) activities available online! Not only are there activities that schools usually do during Computer Science Education Week (csedweek.org), but many organizations are creating additional activities for when families are stuck at home too!

Included are some recommended activities that families can try at home. For even more ideas, check out our Computer Science Remote Learning Guide for Families (tinyurl.com/CS4AllRemoteParent)!

Hour of Code (hourofcode.com/us/learn)

One-hour tutorials designed for all ages and ability levels offered in over 45 languages. These activities are designed to demystify coding and computer science, show that anybody can learn the basics, and broaden participation in the field of CS.

Code.org At Home (code.org/athome)

Code.org wants to support teachers, students, and families in any way they can. One way they are doing this is by putting together a set of resources that can be used to learn computer science at home.

Scratch At Home (sip.scratch.mit.edu/scratchathome/)

The Scratch team is providing children, families, and educators with ideas for engaging in creative learning activities using the free Scratch coding environment. Several times a week new activities are added to the site.

Computer Science Colouring Book (tinyurl.com/CSColouring)

Learn about computers and what makes them tick while you relax and color. Re-imagine computer hardware and software in the colors of your choice, while taking steps on your computer science journey.

Computer Science Glossary

Abstraction - A simplified representation of something more complex

Algorithm - A list of steps to finish a task

Algorithm Design - Creating clear instructions that can be executed without confusion

Binary - A way of representing information using only two options

Bug - An error in a program that prevents the program from running as expected

Code - The language that programmers create and use to tell a computer what to do

Command - An instruction for the computer. Many commands put together make up algorithms and computer programs

Computational Thinking - Modifying a problem in such a way that it can be modeled or solved using a computer or machine. Strategies include: decomposition, pattern matching, abstraction, algorithms

Computer - A machine that runs programs

Computer Science - Using the power of computers to solve problems

Conditionals - Statements that only run under certain conditions

Debugging - Finding and fixing problems in an algorithm or program

Decomposition - Breaking a problem down into smaller pieces

F.A.I.L. - First Attempt In Learning

Function - A piece of code that you can easily call over and over again

Internet - A group of computers and servers that are connected to each other

Iteration - A repetitive action or command typically created with programming loops

Loop - The action of doing something over and over again

Markup - The code that explains how a web page should be structured (e.g. HTML)

Pattern Recognition - Finding similarities between things

Persistence - Trying again and again, even when something is very hard

Pixel - A single point or dot of color in a larger image

Program - An algorithm that has been coded into something that can be run by a machine

Programmer - Someone who creates a program

Programming - The art of creating a program

Programming Languages - Different languages have different applications and require different amounts of prior knowledge

Pseudocode - A simple way of writing programming code in English without knowing any programming languages

Remixing - A variant of an original creation made by rearranging or adding to the original

Robot - A machine capable of carrying out complex tasks automatically

Sequence - Commands put in order so computers can read them correctly

Syntax - A set of commands and 'grammar rules' each language has that must be followed

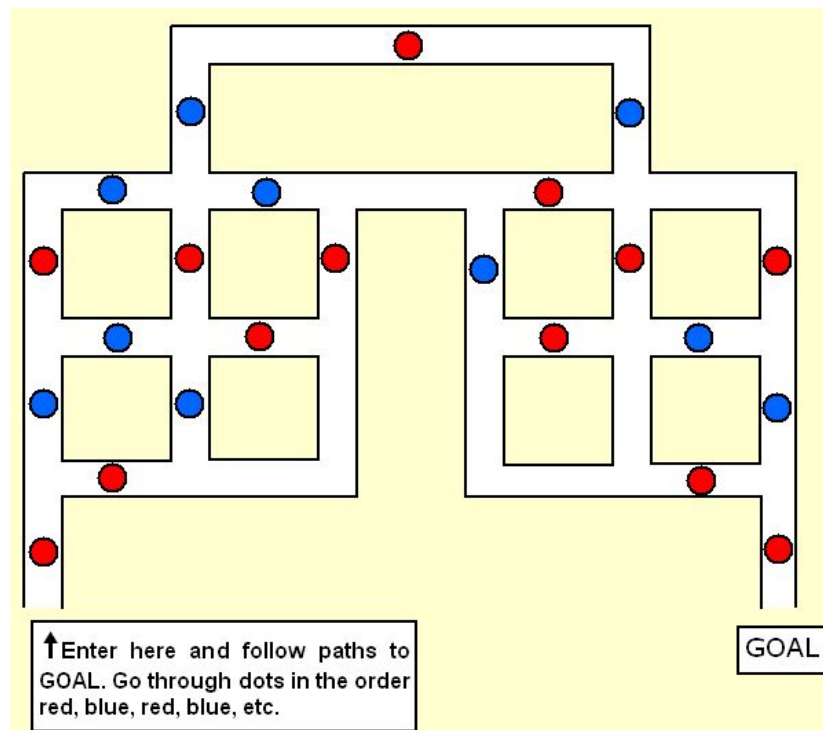
Zine - A self-made publication that might look like a small handmade magazine with text, illustrations, and cutout images

A Few Puzzles...

The first group of trainee astronauts are all sitting around the table, waiting to start their first day of training. From the clues given below, can you work out where everyone sits?

Note: Seat 1 is next to Seat 2 and Seat 8, etc. Seat 5 is across from Seat 1, and Seat 7 is across from Seat 3, etc. Seat 2 is a higher seat number than Seat 1, etc.

1. William is next to Alisa and Nick.
2. William is across from Gabbie.
3. Amanda is next to Sarah.
4. Sarah is across from Eric.
5. Nick is next to Eric.
6. Sydney is at Seat 4 and sits next to Gabbie.
7. Gabbie has a higher seat number than Sydney.
8. Alisa is not in Seat 2.



At the recent spring fete, four keen gardeners were each displaying their two fine roses. In total there were four colours and each rose colour appeared twice.

From the clues below can you tell who had which colour roses?

- Mr Green had a yellow rose.
- Mr Yellow did not have a red one.
- Mr Red had a blue rose but not a green one.
- Mr Blue did not have a yellow one.
- One person with a red rose also had a green one.
- One person with a yellow rose also had a blue one.
- One of the persons with a green rose had no red.
- Neither of the persons with a yellow rose had a green one.
- No person has two roses of the same colour.
- No two persons had the same two colour roses and their names provide no clues.

Instructions: Fill in the missing numbers (from 1 to 9) to solve the Sudoku puzzle. Each column, row and 3x3 subgrid **must** only contain each number once.

2	9			5	6			1
	8	6		9	1	2	4	5
4		1		3	8	6	9	
9	4	5		7	2	1	6	
	1			6	9	5		
6		3		4	5	9	7	8
8		9	5	2	3	4	1	6
	3	2			4	7	5	
	6	4	9	1		3		

...And Some Jokes!

Q: How many programmers does it take to change a light bulb?

A: It can't be done. It's a hardware problem!

Q: What did the spider do on the computer?

A: It made a website

Q: What do you call a pirate with a Computer Science Degree?

A: A programerrrrrrrrrr!

Q: What did the computer do at lunchtime?

A: It had a byte to eat!

Q: Why did the computer show up late to work?

A: It had a hard drive.

Q: What do you call 8 Hobbits?

A: A Hobbyte!

Q: Why do many Java programmers wear glasses?

A: Because they don't C#!

There are 10 types of people in the world, those who understand binary, and those who do not.

Algorithm (noun.)

Word used by programmers when they do not want to explain what they did.

Endless Loop: n., see Loop, Endless.

Loop, Endless: n., see Endless Loop.

Q: Why do programmers always mix up Halloween and Christmas?

A: Because Oct 31 == Dec 25!

Q: What do you call a good joke about computer science?

A: Trick question, there are none!



Get Computer Science Education into Your School!

Computer science (CS) is the study of the capabilities and limitations of computers to help humans solve problems creatively. Rather than being passive users of a computer, children learn to create with a computer. CS provides children with the opportunity to learn computational thinking, problem-solving, creativity, and critical thinking—skills that are relevant to and support many other subjects. CS lessons are a creative outlet and can empower your children to change the world.

Parents Who Love CS

If you loved any of the activities from this pack, **encourage your child's school to join** the Computer Science for All community by going to cs4all.nyc!

Schools Who Want CS

Principals and teachers can **learn more and register** to bring computer science education to their school by going to cs4all.nyc!