STEM OUTREACH PRESENTS:

STEM EACH DAY KEEPS THE BOREDOM AWAY

THE CODING EDITION

GUESS WHAT? IT IS SCREEN FREE AND HANDS-ON!

CODING WITH BEADS: BINARY

SUPPLIES: BEADS AND STRING/PIPE CLEANERS

- Pre-K to 2nd grade
  - Introduce words and concepts like computer language and pattern
  - https://www.sixthbloom.com/earthworm-screen-free-coding-for-preschoolers/
  - This activity works best with pipe cleaners. If your child does well, try having them draw their own Earthworm and pattern.
- 3rd to 6th grade
  - MDA STEM Activity – refer to end of document for activity sheet.
  - Use the Activity Sheet to introduce new vocabulary.
- 7th to 12th grade
  - Use the Activity Sheet in the 3rd-6th grade link to introduce the concepts and vocabulary.
  - Use this link to take the concept a step further. https://www.steamsational.com/secret-message-coding-bracelets/

*Bead alternatives: different types of pasta, colored straws cut into smaller pieces, colored candies, Cheerios, hex nuts, and washers

CODING WITH BLOCKS

SUPPLIES: ANY TYPE OF BUILDING BLOCKS

- Pre-K to 2nd grade
  - Introduce concepts such as sorting and patterns.
  - https://team-cartwright.com/lego-coding-activities/pipe cleaners
  - Try to get through Level 1 and 2. If your child can read, try to make it through Level 4.
- 3rd to 6th grade
  - https://team-cartwright.com/lego-coding-activities/pipe cleaners
  - Skip Level 1 and make it through Level 4.
    - Introduce how computers use patterns in languages such as binary.
  - https://researchparent.com/coding-a-lego-maze/
    - Try to make it through Levels 1 and 2.
    - This activity requires some prep work, but can be completed without the blocks.
- 7th to 12th grade
  - https://researchparent.com/coding-a-lego-maze/
  - Start with Level 2, but try to make it through Level 4.
  - This activity requires prep work, but can be completed without the blocks

CODING OUTSIDE: COMMANDS

SUPPLIES: CHALK/PAINTER'S TAPE AND WATER GUN

https://teachyourkidscode.com/screen-free-coding-activity/

- Pre-K to 2nd grade
  - Introduce the "computer/robot," "programmer," and "command" concepts.
  - Work on the Easy Version
  - If your child struggles with direction, try coloring the squares. Then commands can be "move into the green square" instead of "move left."
- 3rd to 6th grade
  - Introduce the "computer/robot," "programmer," and "command" concepts.
  - Work on the Easy Version first then move to the Medium Version
- 7th to 12th grade
  - Introduce the "computer/robot," "programmer," and "command" concepts
  - Work with the Medium Version then move to the Hard Version.

*Water gun can be replaced with silly string, soft balls, or if you want to get crazy just use the water hose! The grid can be made of anything that provides separation between the sections: rope, yarn, rolled up towels, etc.

CODING IN THE DARK: CAUSE AND EFFECT

SUPPLIES: GLOW NECKLACES

https://teachyourkidscode.com/cause-and-effect-activity-dark/

- Pre-K to 2nd grade
  - Introduce the concept of conditional statements; review examples contained in the link. Introduce the "computer/robot," "programmer," and "command" concepts. If you have done the other experiments, try to also introduce "events."
  - Stick to the simple section of the activity. If you want to add complexity try "If I say G, run to the green circle" or "If I say lemon, run to the yellow circle."
- 3rd to 6th grade
  - Introduce the concept of conditional statements; review examples contained in the link. Introduce the "computer/robot," "programmer," and "command" concepts. If you have done the other experiments, try to also introduce "events."
  - Try the more complex section of this activity using claps or even random words.
- 7th to 12th grade
  - Introduce the concept of conditional statements; review examples contained in the link. Introduce the "computer/robot," "programmer," "command," and "event" concepts.
  - Try the more complex section of this activity using claps or even random words.
  - To increase complexity even more, try having them write their own "event" in which their "computer" steps into each color.

* Glow Necklaces can be replaced with colored paper.

CODING WITH CUPS: ALGORITHMS

SUPPLIES: CUPS

https://jdaniel4smom.com/2017/07/stem-coding-for-kids-cup-stacking-algorithms.html

- Pre-K to 2nd grade
  - Introduce the word "algorithm."
  - Simplify the directions in the link by building a cup stack and have your child copy the stack following directions that you give them. They are the computer and you are the programmer. Then swap roles.
- 3rd to 6th grade
  - Introduce the concept of "algorithms."
  - Build a cup stack with you child and complete the "algorithm" with them. Next, have your child build and create the algorithm on their own, but stay close to help troubleshoot. Finally, follow their directions to recreate their cup stack. If you finish and your stack does not match theirs help them troubleshoot their algorithm.
- 7th to 12th grade
  - Introduce the concept of "algorithms."
  - Follow the steps in the link, but stay close to help trouble shoot. Finally, follow their directions to recreate their cup stack. If you finish and your stack does not match theirs help them troubleshoot their algorithm.

* For added fun!! https://en.wikipedia.org/wiki/Rubber_duck_debugging Use this method to help with troubleshooting.

GET CONNECTED.

Science: https://www.youngscientistlab.com/index.php/user/register?destination=/index.php/competition/video_challenge/enter ... it's a video competition! Deadline May 7

Technology: http://appinventor.mit.edu/

Engineering: https://bigdiyideas.com/35-fun-diy-engineering-projects-kids/

Mathematics: http:s://buildmathminds.com/freebies/

Children's Health and Wellbeing:

- https://www.childtrends.org/publications/resources-for-supporting-childrens-emotional-well-being-during-the-covid-19-pandemic
- https://www.karatelessonsonline.com

STEM PARTNERS HAVE ALSO SENT OUT SOME HELPFUL LINKS.

- NASA's One Stop Shop for STEM: https://www.nasa.gov/specials/nasaathome/index.html
  - NASA STEM @ Home for Students Grades K-4: https://www.nasa.gov/stem-at-home-for-students-k-4.html
  - NASA STEM @ Home for Students Grades 5-8: https://www.nasa.gov/stem-at-home-for-students-5-8.html
- Online Database of Education Free and Discounted Technology Tools: https://www.techforlearners.org/
- Seven NSF-supported STEM resources that are perfect for at-home learning: https://beta.nsf.gov/science-matters/seven-nsf-supported-stem-resources-are-perfect-home-learning
- USGS Learn from Home – Updated weekly with new content: www.usgs.gov/learnfromhome
- Planetary Learning that Advances the Nexus of Engineering, Technology, and Science: https://planets-stem.org/

STEM PARTNERS HAVE ALSO SENT OUT SOME HELPFUL LINKS.

- Building a Greenway - Case Study: https://www.epa.gov/enviroatlas/building-greenway-case-study
- Connecting Ecosystems and Human Health: https://www.epa.gov/enviroatlas/connecting-ecosystems-and-human-health
- Introduction to Ecosystem Services: https://www.epa.gov/enviroatlas/introduction-ecosystem-services
- Explore Your Watershed: https://www.epa.gov/enviroatlas/exploring-your-watershed
- NOAA's Resource Collections: https://www.noaa.gov/education/resource-collections
- Data in the Classroom: https://dataintheclassroom.noaa.gov/
- Smithsonian Learning Lab: https://learninglab.si.edu/distancelearning
- Expanding Innovation Hub: https://www.uspto.gov/blog/director/entry/uspto-launches-the-expanding-innovation
- Activities for Students and Families Stuck at Home: https://ies.ed.gov/blogs/research/post/activities-for-students-and-families-stuck-at-home-due-to-covid-19-coronavirus

FOR QUESTIONS OR HELP PLEASE CONTACT
STEM@MDA.MIL

WE WOULD ALSO LOVE TO RECEIVE PHOTOS OF YOU AND YOUR CHILDREN "STEM-ING OUT"!

CODING BASICS

What is Code?

Coding requires computational thinking.... breaking down big tasks into simple parts. Learning computational thinking is a vital skill that spans all disciplines of life and careers!

Computer code allows humans, the **programmers**, to instruct computers to perform specific tasks. There are many types of coding languages, like C++ and Java. Humans use coding languages to input **code**—characters, digits, and symbols—into the computer. This is called **encoding**.

The computer's "brain," also known as a processor, translates the code into **binary**. Binary is a combination of ones (1) and zeros (0) that the computer recognizes. This is called **decoding**. Now, the computer is able to perform the tasks that the programmer encoded!

The good news is, you don't need a computer to learn the crucial skill of coding! This activity will teach you some coding basics, as you use the Binary Decoder Key on the following page to make a binary code bracelet.

Key Vocabulary

BINARY – A way to represent information using only two options. In the computer world, this is a 1 or a 0.

BIT – It is one of eight digits in a byte.

BYTE – A group of eight bits. One Byte = One keyboard character.

CODE – Digits, symbols, or characters only the computer understands.

CODING – The act of encoding, or entering information, so the machine knows what to do.

DECODING – Converting a coded message into something familiar.

ENCODING – Converting a familiar message into code.

NIBBLE – Two groups of four bits.

PROGRAMMER – A person who writes code using a computer language.

Parents/Guardians – you may need to assist your child with this activity.

CODING BASICS

Understanding code is knowing the language of computers, which is necessary as a computer programmer.

Fun Fact:
A group of eight bits is called a byte

K = 01001011
byte

Fun Fact:
A grouping of four bits is called a nibble

K = 01001011
nibble nibble

BINARY DECODER KEY

A	■□■■	■■■□	I	■□■■	□■■□	R	■□■□	■■□■
B	■□■■	■■□■	J	■□■■	□■□■	S	■□■□	■■□□
C	■□■■	■■□□	K	■□■■	□■□□	T	■□■□	■□■■
D	■□■■	■□■■	L	■□■■	□□■■	U	■□■□	■□■□
E	■□■■	■□■□	M	■□■■	□□■□	V	■□■□	■□□■
F	■□■■	■□□■	N	■□■■	□□□■	W	■□■□	■□□□
G	■□■■	■□□□	O	■□■■	□□□□	X	■□■□	□■■■
H	■□■■	□■■■	P	■□■□	■■■■	Y	■□■□	□■■□
			Q	■□■□	■■■□	Z	■□■□	□■□■

BRAINSTORM

DETERMINE WAYS TO REPRESENT BINARY, OTHER THAN BOXES THAT ARE FILLED OR NOT FILLED.

CODING UNPLUGGED

Code your Initials using a Binary Decoder Key

Find the first, middle, and last letter of your name in the Binary Decoder Key. Color in each box to match the binary letter.

First Initial

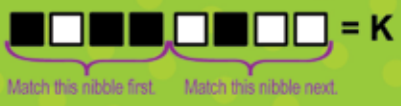
Middle Initial

Last Initial

PROCEDURE

MATERIALS:
1 - Elastic cord
Colored beads
Binary Decoder Key

1. To code your initials:
   a. Find your three (3) initials on the *Binary Decoder Key*.
   b. Color in the boxes on your work space to match the binary letter.



2. Next, choose one color from your bead bag to represent the dark square "■" and another color to represent the light square "□". The third color will represent spaces between your intials.

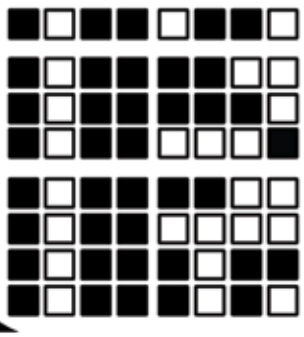
3. Place your colored bead on top of each corresponding box you selected in Step 2.
4. Make sure you have a spacer bead before and after each letter (byte). Placing your spacers keeps you from forgetting any beads later.

Learn to encode binary in fashion!

STRING YOUR BRACELET:

1. Start by folding your string in half, so you have a loop at one end and even lengths at the other end.
2. String your beads over the looped end, in the order established in the Procedure section, starting with your first spacer and then your first byte (see Photo 1). The pattern should be: spacer, eight (8) bits beads, and spacer.
3. Repeat Step 2 above, for the next two letters (the elastic string will keep the beads from sliding off the end).
4. To finish, add three (3) spacers after your last initial (byte) sequence.
5. Thread one open-ended string through the loop (see Photo 2).
6. Tie the two open strings together to make a knot. Repeat to make a second knot (see Photo 3). Pull knot very tight.
7. Cut the excess string a 1/2" from the knot. (see Photo 4).

Can you figure out what the message says?



___

___ ___ ___

___ ___ ___ ___

(Solution On Back Page)

Make your own code message below:

MDA STEM

SCIENCE • TECHNOLOGY • ENGINEERING • MATH

OUTREACH

E-MAIL

STEMOutreach@mda.mil

PHONE

256-450-4000

WEB SITE

www.mda.mil/STEMOutreach

(Message Solution: I CAN CODE)

MISSILE DEFENSE AGENCY

ADVANCED TECHNOLOGY

HSV-G-1132-18