INCLUSIVE DIGITAL MAKER FUTURES FOR CHILDREN VIA PHYSICAL COMPUTING

https://aka.ms/idmf24

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WORKSHOP GOALS

- Facilitate discussions about inclusive digital making for children using programmable micro-controllers
- Explore the benefits and challenges of inclusive digital making
- Discuss open questions and future directions for the field

OVERVIEW

- 9:00 – 9:30 Introduction
- 9:30 – 10: 30 MicroCode presentation, working session
- 10:30 – 11:00 BREAK
- 11:00 – 12:30 talks
- 12:30 – 13:30 LUNCH
- 13:30 – 15:00 talks
- 15:00 – 15:30 BREAK
- 15:30 – 17:00 a surprise…
- 17:00 – 17:30 SUM UP

INTRODUCTIONS

- Workshop organizers
- Attendees

- Name
- Institution, Country
- Your interests, briefly

CONVEYING PHYSICAL COMPUTING TO NEW AUDIENCES WITH MICROCODE

THOMAS BALL, MICROSOFT RESEARCH

JUDITH BISHOP, STELLENBOSCH UNIVERSITY

MICRO:BIT EDUCATIONAL FOUNDATION

- https://microbit.org
  - "*inspire every child to **create** their best digital future*“
  - “***reducing barriers of access**, for children living in different social and economic contexts around the world*”
- Over 9 million micro:bits distributed to date
  - But few to developing countries
  - Main programming environments are web-based (computers)

WORLD STATS

Percentage of USA Households With At Least One Computer – 94.6% (2024)
timeline_cir

As of 2020, 40% of digital learning platforms were accessed via personal computers.

Global smartphone penetration 2023 69% (Statista)

World-wide computers at home 47% in 2019 (Statista) – in Africa 7%

54% of the global population now owns a smartphone (GSMA 2023)

Cellphone penetration in Sub-Saharan Africa is 55 percent as of late 2023 (Statista)

44 million students have learned with micro:bit
9 million micro:bits have been distributed (Micro:bit Foundation)

NEW AUDIENCES

- Younger children (6-10)
- Parents
- New teachers into STEM
- Older people

WHAT THEY WANT

• Young children	things that move and excite
• Parents	instructions, kit mustn't break
• Teachers	be in control, low cost factor
• Older people	relate to what they already know

CHALLENGES

1. Failure modes not understood
2. Instructions so far only online
3. Where to go for help

Max (7) uses a Robot

MICROCODE

- Goals:
  - bring the joy of creating to teachers and students lacking access to computers, internet and power
  - bring the micro:bit experience to earlier ages
- Give legs to the MEF's goal of reducing barriers of access
- Breaks assumptions of Literacy and Arithmetic (adding numbers, fingers)

MICROCODE: HTTPS://AKA.MS/MICROCODE

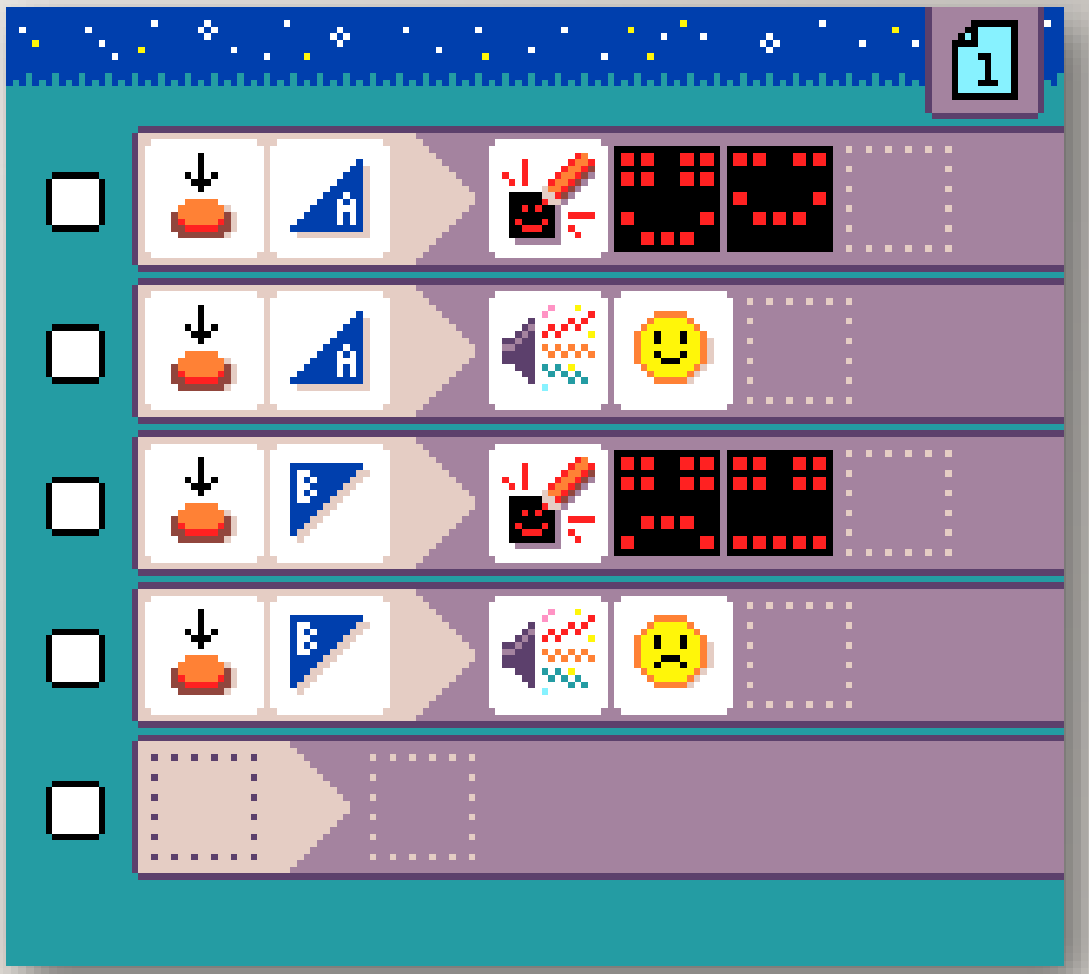
- MicroCode is a MakeCode Arcade app that runs on micro:bit V2
- Leverages **four** commercially available Arcade shields for the V2
- Open source https://github.com/microsoft/microcode

PLANS

- A community forum for assistance
- A user guide and a free book
- Roll out to youth groups (Church, Cubs), old age homes and power-deprived schools
- Penetration into under-developed countries

MICROCODE VALUE PROPOSITION

- **Fun and creative**
- **Simple and live**
  - icons first (text second)
  - cursor-based navigation
  - (very) accessible
  - instant micro:bit update



MICROCODE: CONCEPTS

Reactive systems

- Inputs
- Outputs
- Events
- Actions
- Timers

Control flow

- If-Then (When-Do)
- Switching context (page)
- Sequencing
- Iteration

Math

- Variables
- Addition
- Equality

ANALYSES TO DATE

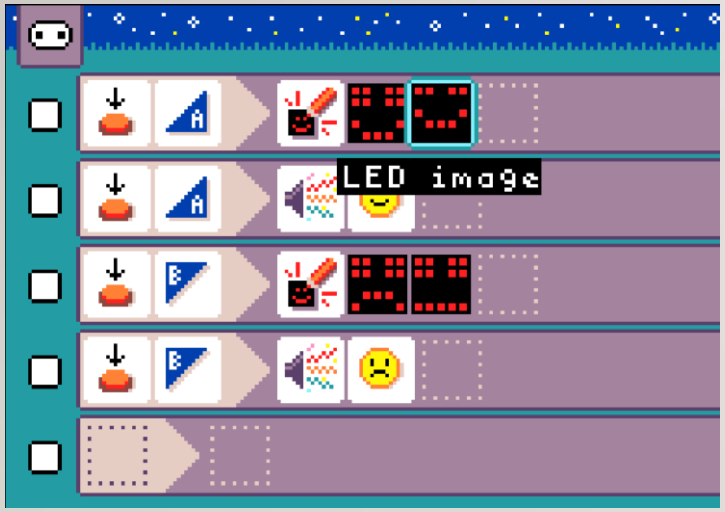
- MicroCode trials in schools in the UK (see IDC paper)
- Of the 87 MakeCode quick projects for the micro:bit on the MEF web site
  - 28/43 Beginner, 11/29 Intermediate, 5/15 Advanced projects
- Teaching with MicroCode
  - one focused on micro:bit, the other on robots

CURSOR-BASED EDITING

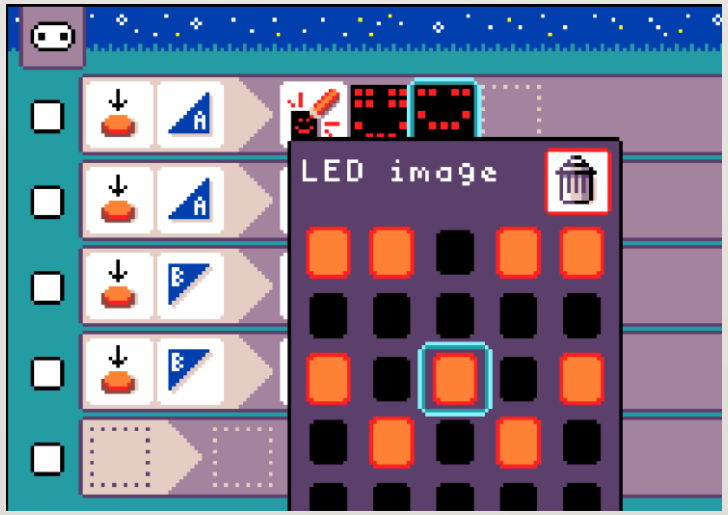
Action	Shield
Move cursor	Direction pad
Select item	A button
Go back	B button

CURSOR PRACTICE

Move to an LED image and select



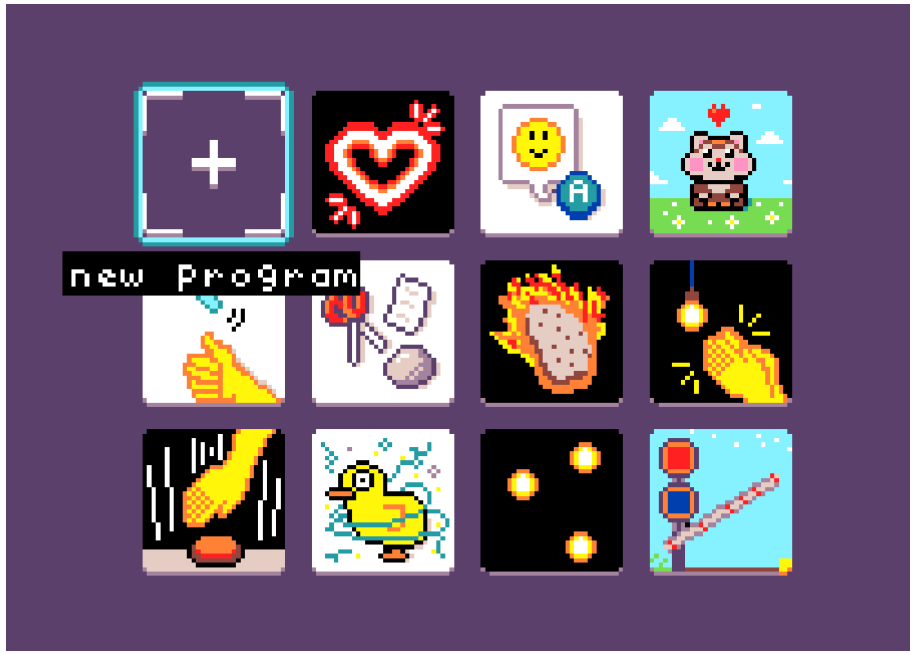
Change the LED image

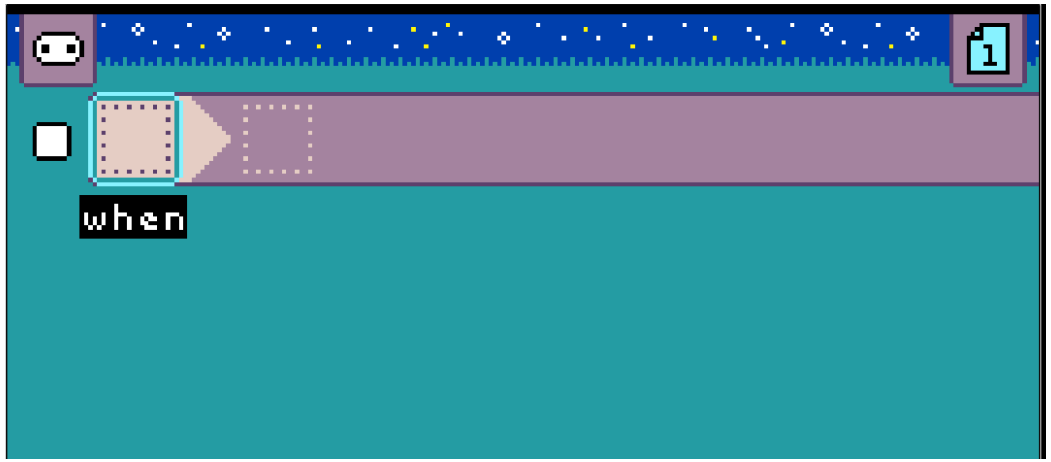


Dismiss LED image editor

Select to toggle LED

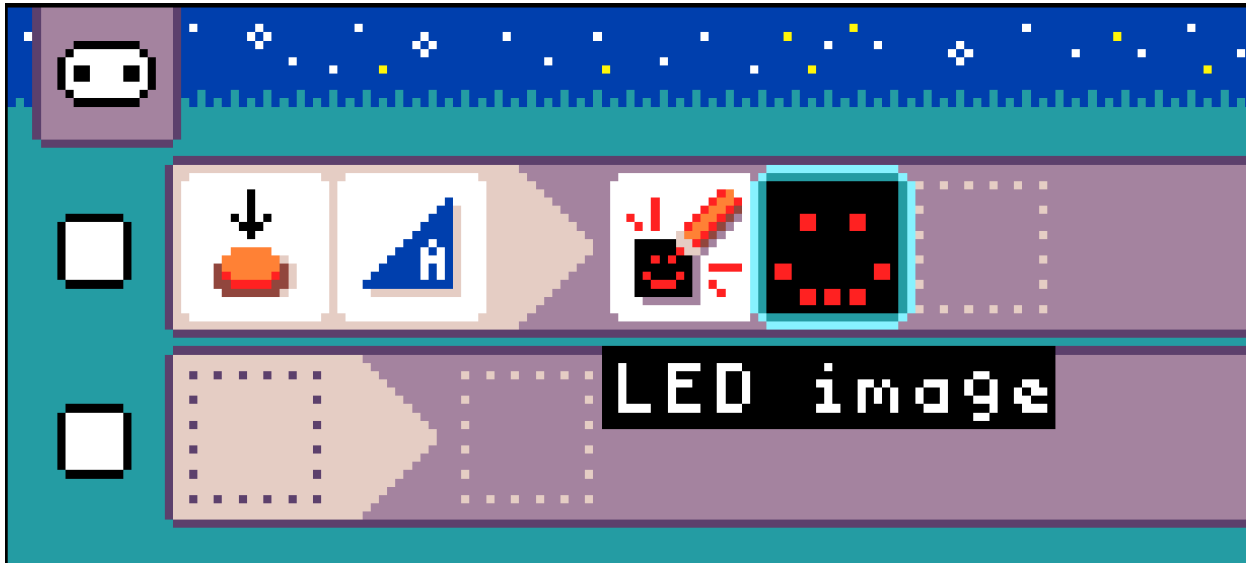
Starting from scratch





“Space Out”!

Press Space (or A button) to create your first rule…



Create second rule for micro:bit B button

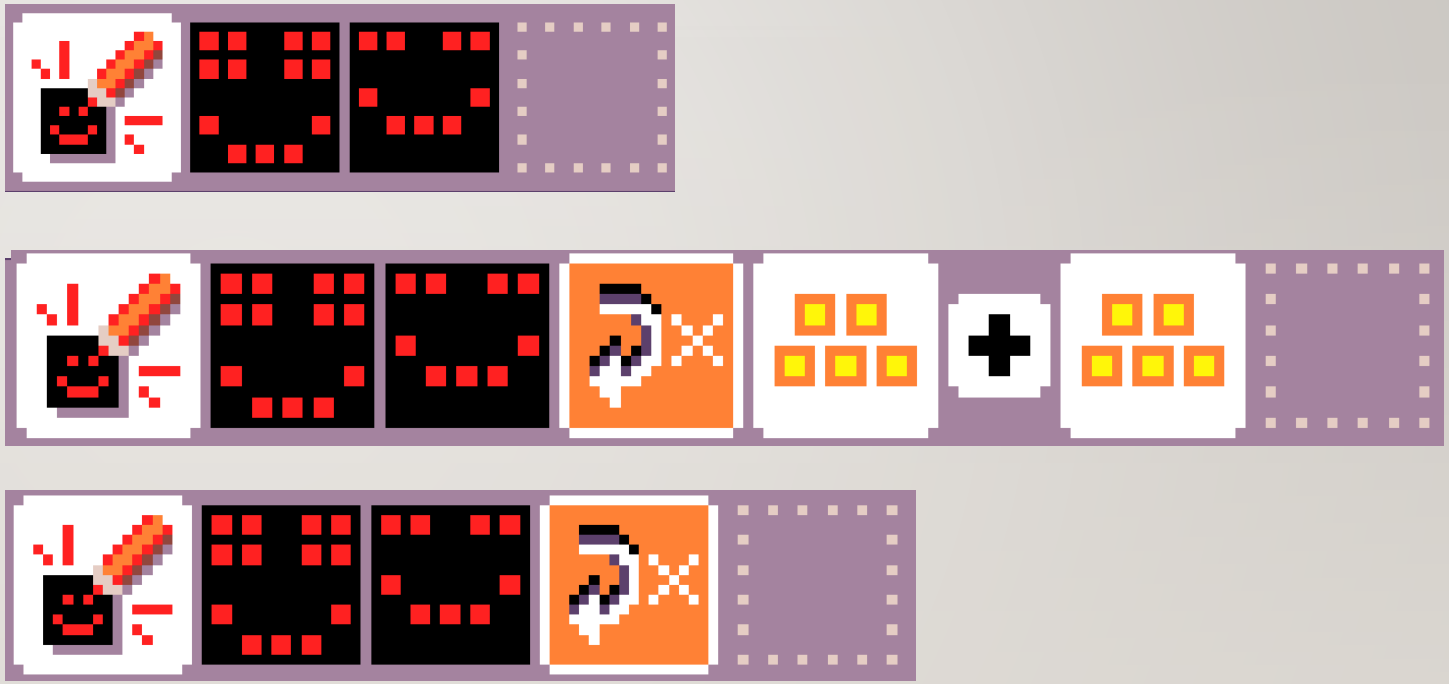
WHEN …

press
release
accelerometer
sound
temperature
light sensor
radio receiver
start page
timer
variable

DO… A COMMAND OR ACTION

SEQUENCING AND REPETITION

- Sequence of LED images yields an animation
- Arrow tile to repeat
  - Constant # of times
  - Forever (if no value)
- Sequencing/repeat also for
  - sounds
  - music

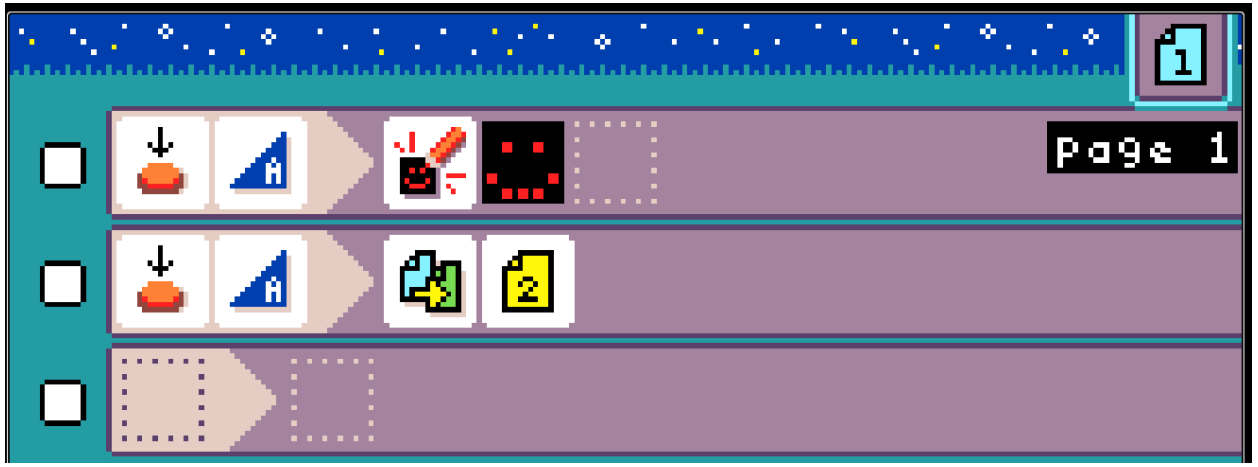


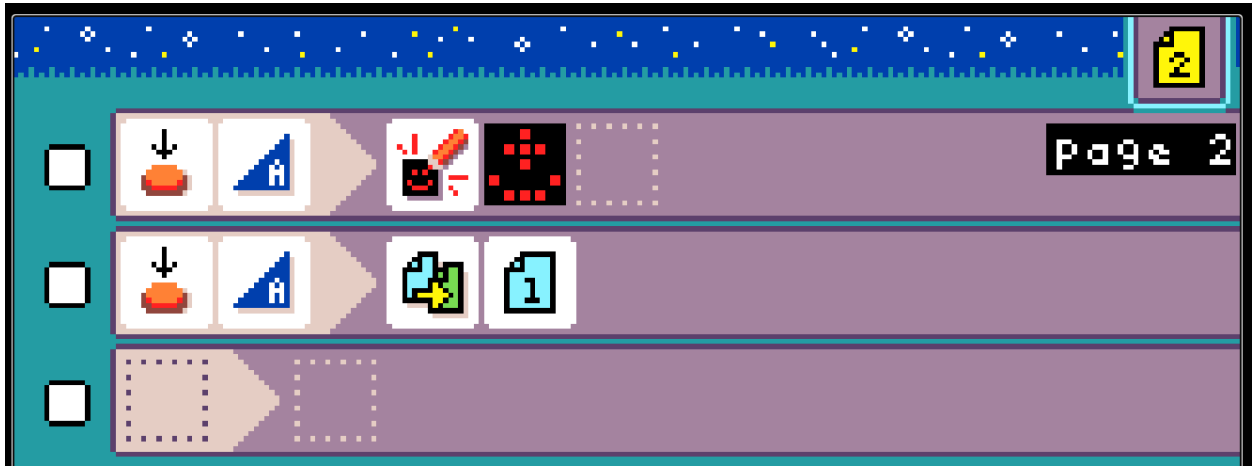
Question

- Can you program the micro:bit to alternately
  - display smiley face on press of A button
  - display sad face on press of A button

- Hint
  - Use switch page command

One button, two pages!



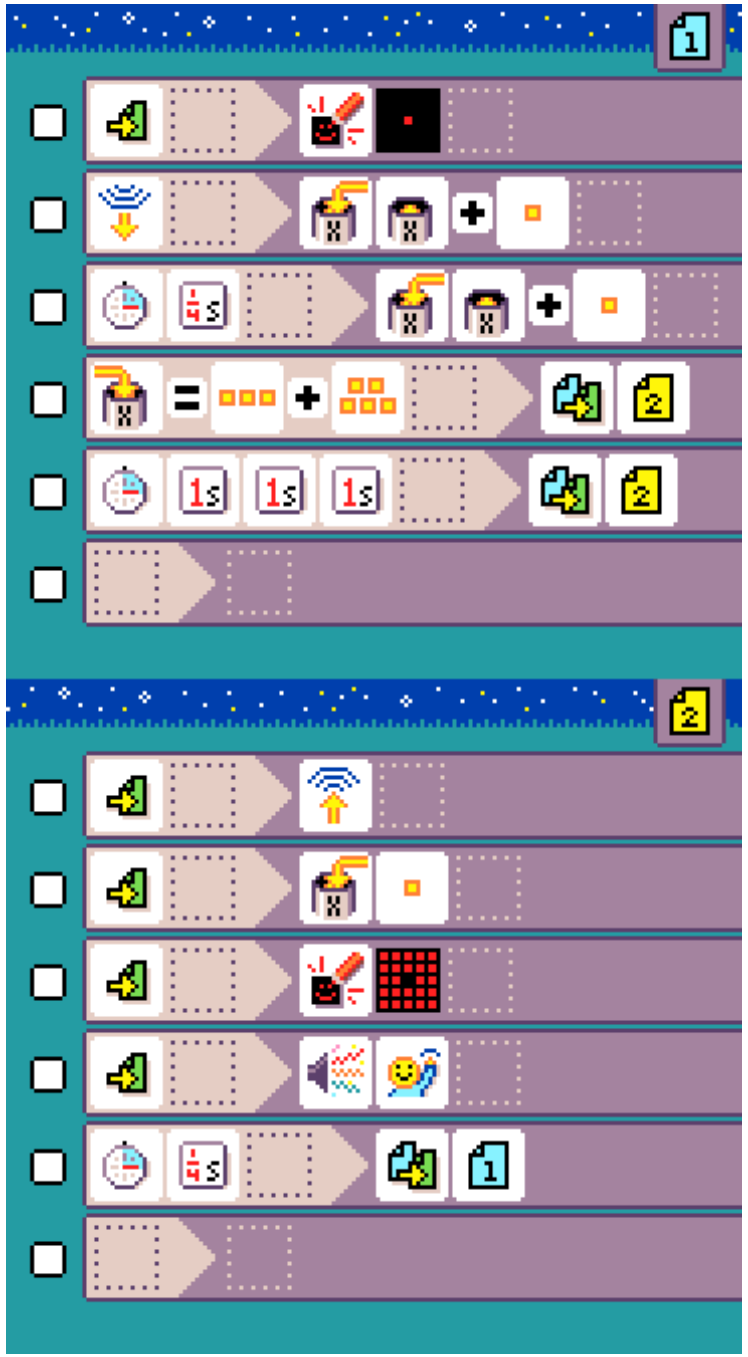


Rock, Paper, Scissors

Step Counter

Chuck-a-Duck

Fireflies



Finishing Up

1. Dinner: 7pm @ Moodz
2. Jacdac: if you need them for your research, keep 2 modules + 2 cables
3. Slides
4. MicroCode forum???
5. Joe Finney
    1. Micro:bit Education Foundation + Academia! Reach out to Joe!
    2. Thanks!!!