5.CSY.2 Computing Systems

> *The student will describe an automated decision-making process employed by a computing system. (a) Explore decision automation and how it is used. (b) List outcomes of a process based on automated decisions.*

Understanding the Standard

The average child makes about 3,000 decisions each day, and the average adult makes about 35,000 decisions per day. When some of these decisions can be delegated to a computing device, it can free up human time and energy for other pursuits. However, since decision-making programs only approximate human decisions in the real world, imperfections in the way human logic is translated into code can have unintended consequences. Fifth graders have already learned that every control structure reduces to a binary ("yes or no," "true or false," "this or that") decision about what to do next. However, human decision making is incredibly more complex than a simple binary choice. How complex and nuanced a program's decisions are is dependent on how human decision makers specified their requirements and how these requirements are coded into the program. In the context of this standard, "listing outcomes" refers to accurately and reliably "tracing," or simulating, the execution of a program in one's head or on paper, while raising questions about the limitations of each choice the computer is making.

Term	Definition
Automation	The use of technology to accomplish a task with as little human interaction as possible. (adapted from [ComputerHope]).
Outcome	Result generated by an automated decision-making process based on input data and predefined rules or algorithms.
Trace	To mentally simulate the execution of a computer program without a computer, but possibly with other non-computer aids such as paper.

Prerequisite Knowledge

To engage with this standard, students should have an understanding of the use of conditional control structures in programming.

Integration Opportunities

English 5.RI.1b, 5.RI.3a Explore how automated decision making (ADM) can be used to make reading recommendations based on data collected.

Physical Education 5.4d Have students create a decision tree to design a process for improving moods and reducing stress levels. Evidence includes slowed heart rate, calm breathing and clear communication.

Math 5.NS.1a Design a physical activity where students sort and compare sets of fraction cards (with denominators of thirds, eighths, and factors of 100) to match equivalent decimal forms, and discuss how decision-making algorithms can be used in computing to organize and order data efficiently.

Summary of a Lesson

Brainstorm a list of school procedures that require decisions to be made by students or staff. Some examples include packing a backpack at the end of the school day, selecting items for school lunch, getting ready for recess, or sending overdue notices from the library, but should come from the typical operations of your school. Have students select a procedure and prepare an algorithm for automating that procedure, including when and how a computer would make decisions that affect the process. Students may represent their algorithms using pseudocode or decision trees. In pairs, list the outcomes of each algorithm, testing it with a variety of inputs where data may not return a result intended by the programmer. Revise the algorithms as needed, and discuss the relationship between an automated process and the context that informs a human decision making process.