IGNITE MY FUTURE

THINK SOLVE CREATE CONNECT

LESSON TITLE

Astronaut, Musician, or Politician?

Guiding Question: Is Life Fair?

SUBJECTS

English/Language Arts
Social Studies
Science

COMPUTATIONAL THINKING PRACTICE

Recognizing and Defining Computational Problems

COMPUTATIONAL THINKING STRATEGIES

Find Patterns
Develop Algorithms

MATERIALS

Astronaut, Musician, or Politician research sheet

Flowchart Shapes student handout

Astronaut Flowchart Draft student handout

Computers with Internet access

Ignite Curiosity

- Did you know that Canadian politicians and other world leaders are usually tall? Why might this be the case?
- Are musical "geniuses" born or formed by their environment? Why do you think so?
- Why might a baseball coach try to teach a promising pitcher to pitch left-handed?

What makes someone good at what they do? Is it nature, nurture, or both that influence our success? In his bestselling book *Outliers*, Malcolm Gladwell makes the case that at least some of our success comes from our genetic makeup. Are some careers out of reach for certain people because of their physical traits? How can thinking like computers help us overcome or compensate for physical limitations that prohibit or hinder us from pursuing our passions? In this lesson, students will use the computational thinking strategies of finding patterns and developing algorithms to outline how a person who does not possess a certain genetic trait can become successful at a given skill. In **THINK**, students will collaborate to brainstorm specific careers that are associated with certain inherited traits. They will use these data to research and find patterns in **SOLVE**. Using the patterns they find and the examples of algorithms on the free Drawio website, they will **CREATE** an algorithm that demonstrates how these inborn characteristics can be overcome. In **CONNECT**, students will communicate and evaluate their algorithms and explore more about the careers they have researched.

Students will be able to:

- **Evaluate** the computational problem of traits that influence success,
- **Analyze** patterns to create rules and solve the problem, and
- **Create** algorithms to show where technology can make careers accessible to more people.

Students will first brainstorm a list of inherited traits of a career group to research and attempt to answer the *why* behind these trends.

1 **Read** the following scenario to students:

Are some careers out of reach for some people because of their physical traits? Your team will think like a computer by brainstorming patterns of career groups to research and then writing an algorithm to find ways to make these careers accessible to more people.

2 **To begin,** organize students into teams and distribute copies of the Astronaut, Musician, or Politician research sheet to help them organize their thinking.

3 **Tell the students** that right now they will be completing only the first and second columns on the capture sheet: Career Group and Inherited Traits: Hypothesis.

4 **Then, kindle the students' brainstorming** activity by asking the following guiding questions. You can record students' responses on the board or in a central location.

- *What are some career groups that seem to have genetic patterns that help people in these careers do their job?*
- *Which of these career groups could we research? We will need groups for which data have been recorded. For example: Could we research the body size of astronauts? (Tall, short, or all sizes?) What about world leaders? (Tall, short, with mobility or other physical limitations or not?) Baseball likes to keep statistics. What trends could you imagine for pitchers? (Right-handed, left-handed?) What about for catchers? (Short, tall?)*

5 **Once a list of traits has been identified,** instruct students to examine available data to illuminate patterns.

Students will work in teams using provided data sets to find patterns among various careers.

1. **Gather students** for a group discussion and tell them that next they will be attempting to answer the fourth column, Why?, on the Astronaut, Musician, or Politician research sheet.

2. **Tell** the students that they are hypothesizing possible answers that they will attempt to confirm in their research. Be mindful of social/cultural sensitivities.

3. **Discuss with the students:** *As you research today, you will be looking for genetic or inherited traits, and not stereotypes. You will be attempting to confirm through research your hypotheses in the earlier section. You will also be attempting to answer **why** these traits make the careers easier or possible. Why do leaders tend to be tall? If more successful baseball pitchers seem to be right-handed (or left-handed), why? Why must astronauts be within a certain height range?*

4. **Once the students** have reasonable answers or thoughts for each career group, divide them into teams.

5. **Using the inherited characteristics and patterns** discovered in Think and recorded on the Astronaut, Musician, or Politician research sheet, each team will choose a career to research. Some examples of possible career groups associated with genetic traits include the following:
   - Baseball batters: why it is advantageous to be left-handed
   - Astronauts: physical requirements for astronauts
   - World leaders and height
   - What qualities make a musical prodigy?

   Allow students to add data sets that they find and would like to research.

6. **Students should record the data** they find in the Inherited Traits: Facts from Research column on their Astronaut, Politician, or Musician research sheet.

7. **As an extension,** students could research efforts to channel persons with physical disabilities into competitive employment and leadership positions through the University of Delaware's National Leadership Consortium on Developmental Disabilities and other associations.

Students will sort the patterns and organize this data to construct an algorithm for their career group. Then, they will identify a spot in the algorithm where technology could make the career accessible to more people and modify their algorithm to include that technology.

1. **Gather** the students again for a group discussion and allow them to share the research and patterns they have collected.

2. **Tell** students that next they will be attempting to solve the problem of career limitations and make life fairer. Read the following to the students: *Are there ways to enable more people to be successful in a chosen career field? For example, if a person is right-handed, how can he or she still become a successful pitcher? If a person is short, how could he or she become a politician? If a person has poor vision, how could he or she become an astronaut?*

3. **Show** students the Astronaut Flowchart Draft and the Flowchart Shapes student handout.

4. **Explain** to students how the different shapes describe the steps in the pattern of an algorithm.

5. **Emphasize** to students that the algorithm needs to be a closed loop.

6. **Then, divide the students** into pairs and have them explore the Drawio website to learn more about algorithms.
   - Access https://www.draw.io/.
   - Select where to save your diagram (Google, Dropbox, Device).
   - Create a new blank diagram document or use a template.
   - Click the blue Create button at the bottom-right side of the screen to begin.

7. **Using the information** they have learned and the facts and patterns they have found, each pair will write an algorithm on the Drawio website for its assigned career group.

8. **Remind the students** to save their diagram.

9. **Next,** ask each pair to identify a spot in the algorithm where technology could make the career accessible to more people. If astronauts typically need to be tall to fit into a standard seat, are there adjustments that could be made to the seats without compromising safety? What other compensations could be made to overcome the patterns and trends studied in this lesson?

10. **Examples include the following:**
    - A surgery that could correct red-green colorblindness for astronauts
    - Developing new seats or cockpits for astronauts
    - Creating a machine or biomedical apparatus that will help firefighters carry heavy weights
    - Inventing an app to increase musical technique for those who do not have absolute pitch

10 **Have the student pairs trade their algorithm** with another student pair, and ask them to evaluate and make suggestions for improvement.

11 **If students do not have Internet access,** they may manipulate the shapes in Word using the Flowchart Shapes student handout. Alternately, they may draw the shapes using pencil and paper for an analog/historical version of this activity.

Select one of the strategies listed below to help students answer these questions:

- **How do this problem and solution connect to me?**
- **How do this problem and solution connect to real-world careers?**
- **How do this problem and solution connect to our world?**

1. **Write** the three questions on PowerPoint or flip chart slides and invite students to share out responses.
2. **Display** pieces of chart paper around the room, each with one question written on it. Ask students to write down their ideas related to the questions on each sheet.
3. **Assign** one of the questions to three different student groups to brainstorm or research, and then share out responses.
4. **Invite** students to write down responses to each question on a sticky note, and collect them to create an affinity diagram of ideas.

How does this connect to students?

By the end of this lesson, students will have learned many details about patterns in careers. They will have explored ways to overcome barriers or perceived barriers in pursuing a specific career. They will also have experienced the benefit of working in teams, finding patterns, and breaking down tasks into steps, all of which make any daily task or job easier.

How does this connect to careers?

Aerospace Engineers design, construct, and test aircraft, missiles, and spacecraft. These engineers consider the physical requirements for astronaut and others who operate aircraft and spacecraft. In their designs, they must balance safety with the goal of making careers accessible to as many qualified people as possible.

Biomedical Engineers combine engineering principles with medical and biological sciences to design and create equipment, devices, computer systems, and software used in healthcare. These are examples of technology that can help make careers such as those studied in the lesson accessible to more people.

Coaches and **Trainers** teach amateur and professional athletes the skills they need to succeed at their sport. They help players make the most of their skills and improve in areas where they are not naturally skilled.

Sociologists study society and social behavior by examining the groups, cultures, organizations, social institutions, and processes that develop when people interact and work together.

How does this connect to our world?

Students may think that because of their physical or genetic makeup, certain career pathways are closed to them. In today's increasingly technological environment, the range of careers reserved for those who have inherited specific genetic traits is narrower every day. Through finding patterns and writing an algorithm, students will learn that computer thinking can open many previously closed career pathways and can also help life become more accessible.

Just like individuals, successful organizations also follow an algorithm to ensure it is doing well. TATA Constancy Services uses this approach as it is consistently ranked as a top employer in North America. Click here to learn more.

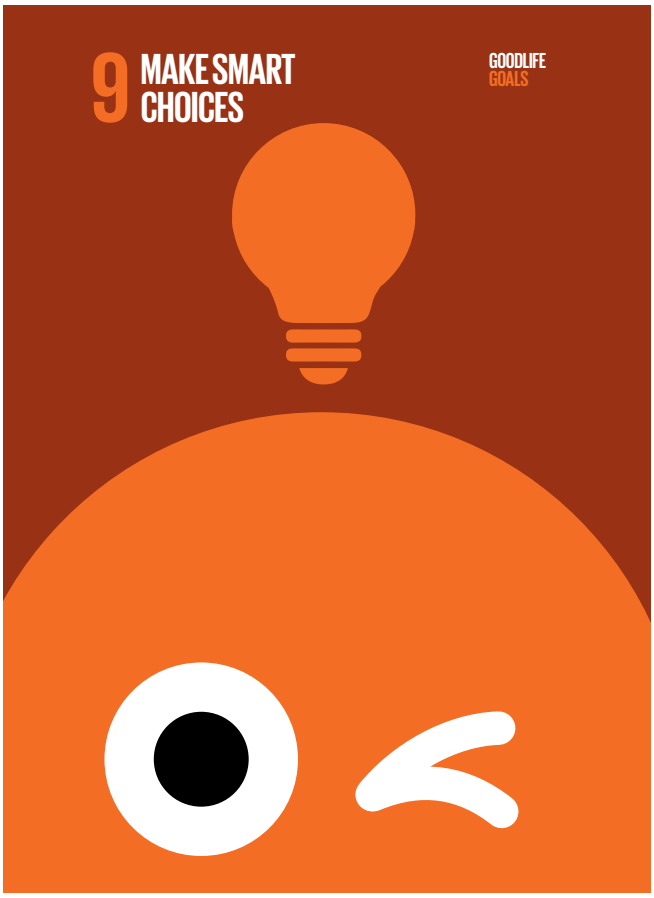
Curriculum Connections

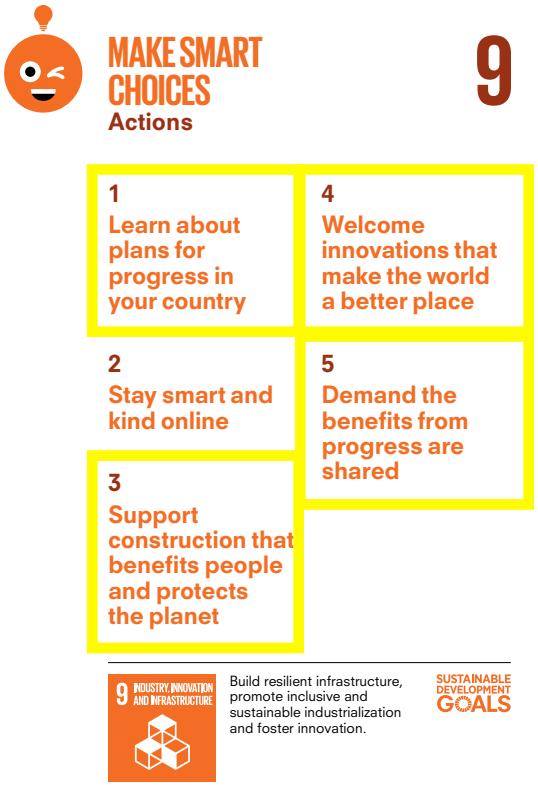
UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

"For the goals to be reached, everyone needs to do their part: governments, the private sector, civil society and **people like you**."
–The United Nations

"The Sustainable Development Goals are the blueprint for a better future. And together we can reach them. By following the Good Life Goals, we can all help make tomorrow better than today. Let's do this! #GoodLifeGoals"





Source:
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Find more easy-to-implement resources to integrate computational thinking practices into your classroom by visiting **ignitemyfutureinschool.ca**

Global Competencies

CMEC (Council of Ministers of Education, Canada) Pan-Canadian Global Competencies Descriptions

Highlighted sections apply to this lesson

Global Competency	Definition	Student Descriptors
Collaboration	Collaboration involves the interplay of the cognitive (including thinking and reasoning), interpersonal, and intrapersonal competencies necessary to participate effectively and ethically in teams. Ever-increasing versatility and depth of skill are applied across diverse situations, roles, groups, and perspectives in order to co-construct knowledge, meaning, and content, and learn from, and with, others in physical and virtual environments.	Students participate in teams by establishing positive and respectful relationships, developing trust and acting co-operatively and with integrity. Students learn from and contribute to the learning of others by co-constructing knowledge, meaning, and content. Students assume various roles on the team, respect a diversity of perspectives, and address disagreements and manage conflict in a sensitive and constructive manner. Students network with a variety of communities/groups and use an array of technology appropriately to work with others.
Communication	Communication involves receiving and expressing meaning (e.g., reading and writing, viewing and creating, listening and speaking) in different contexts and with different audiences and purposes. Effective communication increasingly involves understanding both local and global perspectives, societal and cultural contexts, and adapting and changing using a variety of media appropriately, responsibly, safely, and with regard to one's digital footprint.	Students communicate effectively in different contexts in oral and written form in French and/or English through a variety of media. Students communicate using the appropriate digital tools and create a positive digital footprint. Students ask effective questions to acquire knowledge, listen to understand all points of view, voice their own opinions, and advocate for ideas. Students gain knowledge about a variety of languages and understand the cultural importance of language.

Global Competencies cont.

Highlighted sections apply to this lesson

Global Competency	Definition	Student Descriptors
Global Citizenship and Sustainability	Global citizenship and sustainability involve reflecting on diverse worldviews and perspectives and understanding and addressing ecological, social, and economic issues that are crucial to living in a contemporary, connected, interdependent, and sustainable world. It also includes the acquisition of knowledge, motivation, dispositions, and skills required for an ethos of engaged citizenship, with an appreciation for the diversity of people, perspectives, and the ability to envision and work toward a better and more sustainable future for all.	Students understand the ecological, economic, and social forces, their interconnectedness, and how they affect individuals, societies, and countries. Students take actions and responsible decisions that support quality of life for all, now and in the future. Students recognize discrimination and promote principles of equity, human rights, and democratic participation. Students understand Indigenous traditions and knowledge and its place in Canada, learn from and with diverse people, develop cross-cultural understanding, and understand the forces that affect individuals, societies, and nations. Students engage in local, national, and global initiatives to make a positive difference. Students contribute to society and to the culture of local, national, global, and virtual communities in a responsible, inclusive, accountable, sustainable, and ethical manner. Students as citizens participate in networks in a safe and socially responsible manner.

Global Competencies cont.

Highlighted sections apply to this lesson

Global Competency	Definition	Student Descriptors
Critical Thinking and Problem Solving	Critical thinking and problem solving involve addressing complex issues and problems by acquiring, processing, analysing, and interpreting information to make informed judgments and decisions. The capacity to engage in cognitive processes to understand and resolve problems includes the willingness to achieve one's potential as a constructive and reflective citizen. Learning is deepened when situated in meaningful, real-world, authentic experiences.	Students will solve meaningful, real-life, complex problems by taking concrete steps to address issues and design and manage projects. Students will engage in an inquiry process to solve problems as well as acquire, process, interpret, synthesize, and critically analyse information to make informed decisions (i.e., critical and digital literacy). Students will see patterns, make connections, and transfer what they have learned from one situation to another, including in real world applications. Students will construct, relate, and apply knowledge to all domains of life such as school, home, work, friends, and community. Students will analyze the functions and interconnections of social, economic, and ecological systems.
Innovation, Creativity and Entrepreneurship	Innovation, creativity, and entrepreneurship involve the ability to turn ideas into action to meet the needs of a community. The capacity to enhance concepts, ideas, or products to contribute new-to- the-world solutions to complex economic, social, and environmental problems involves leadership, taking risks, independent/unconventional thinking and experimenting with new strategies, techniques, or perspectives, through inquiry research. Entrepreneurial mindsets and skills involve a focus on building and scaling an idea sustainably.	Students formulate and express insightful questions and opinions to generate novel ideas. Students contribute solutions to complex economic, social, and environmental problems or to meet a need in a community in a number of ways including; enhancing concepts, ideas, or products through a creative process, taking risks in their thinking and creating, making discoveries through inquiry research, and by hypothesizing and experimenting with new strategies or techniques. Students demonstrate leadership, initiative, imagination, creativity, spontaneity, and ingenuity in a range of creative processes and motivate others with an ethical entrepreneurial spirit.

Global Competencies cont.

Highlighted sections apply to this lesson

Global Competency	Definition	Student Descriptors
Learning to learn and to be self-directed and self-aware	Learning to learn and to be self-directed and self-aware, means: becoming aware and demonstrating agency in one's process of learning, including the development of dispositions that support motivation, perseverance, resilience, and self-regulation. Belief in one's ability to learn (growth mindset), combined with strategies for planning, monitoring and reflecting on one's past, present, and future goals, potential actions and strategies, and results. Self-reflection and thinking about thinking (metacognition) promote lifelong learning, adaptive capacity, well-being, and transfer of learning in an ever-changing world.	Students learn the process of learning (metacognition) (e.g., independence, goal-setting, motivation) and believe in their ability to learn and grow (growth mindset). Students self-regulate in order to become lifelong learners and reflect on their thinking, experience, values, and critical feedback to enhance their learning. They also monitor the progress of their own learning. Students develop their identity in the Canadian context (e.g., origin and diversity) and consider their connection to the environment. They cultivate emotional intelligence to understand themselves and others. They take the past into account to understand the present and approach the future. Students develop personal, educational, and career goals and persevere to overcome challenges to reach these goals. They adapt to change and show resilience to adversity. Students manage various aspects of their lives: physical, emotional (relationships, self-awareness), spiritual, and mental well-being.

Astronaut, Musician, or Politician Research Sheet

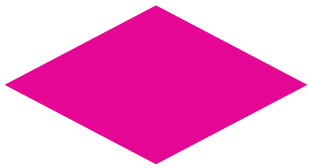
Career Group	Inherited Trait Hypothesis	Inherited Trait Facts from Research	Why?
Astronaut	Tall	Between 5'2" and 6'2"	Needs to fit in seat and reach controls.
Politician	Tall	Tall	Shows a good leader?
Musician			

Flowchart Shapes

Algorithms can be represented by shapes to show the steps involved.

1. Flowcharts use arrows to show the direction that the steps move.

2. A decision loop is the part of the algorithm where a question is answered and the path divides. Typically, there is a "yes" or "no" question, and the path may circle around until the answer is "yes" or terminate in a "no" result.



3. The beginning and the end of the algorithm are marked with a special shape. All paths begin at the beginning and must terminate at the end.

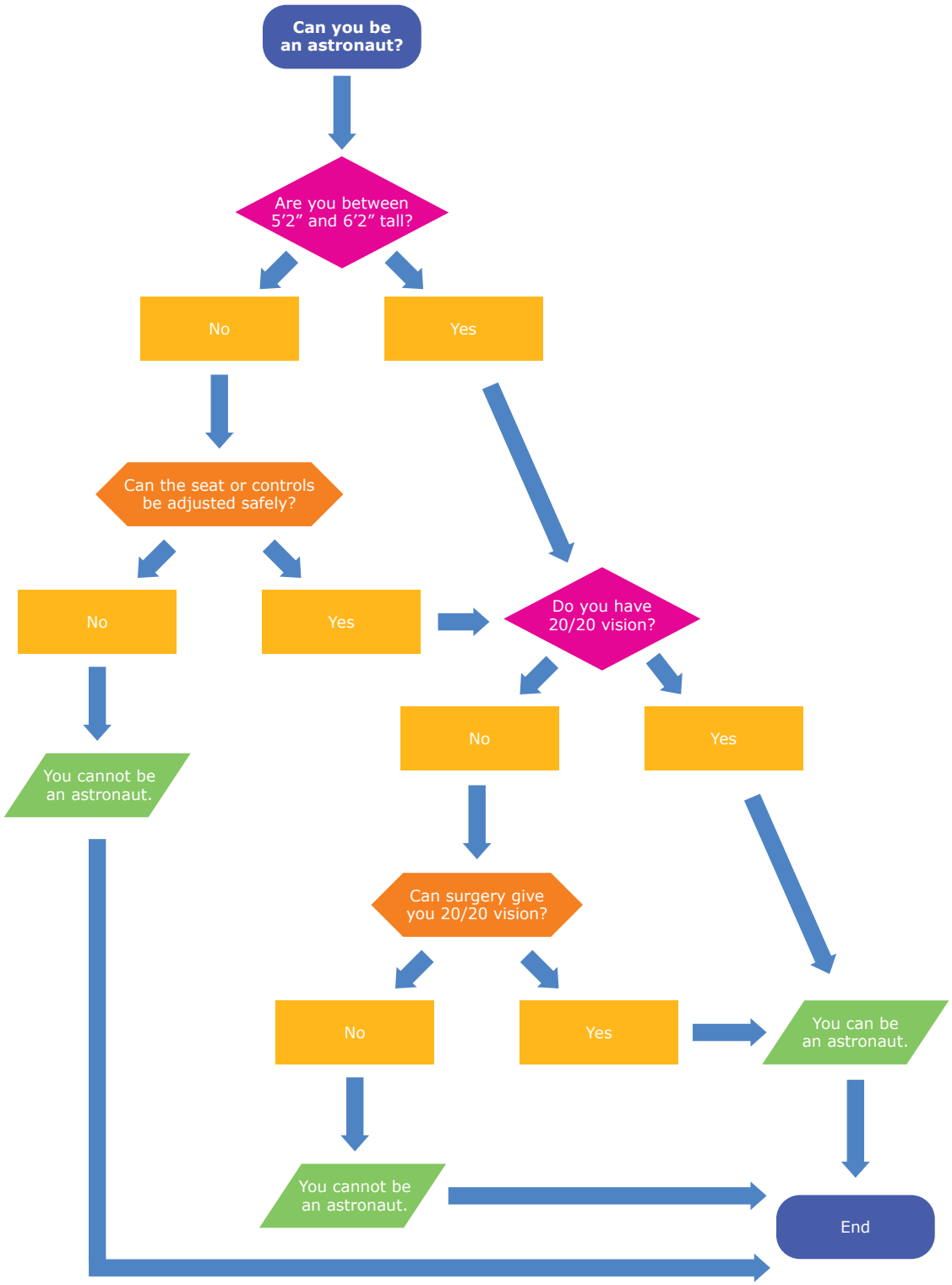
4. The result is what happens after answering the question at the decision loop.

5. The output is the resolution of the result and what would be printed on the screen in the case of a computer algorithm.

6. A decision is where the path divides but does not loop.

Astronaut Flowchart Draft

Astronauts must be between 5 feet, 2 inches and 6 feet, 2 inches tall to reach the controls. They must also have perfect vision (20/20).



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