20 Questions: An Unplugged AI Adventure

Gr. 2-4 Activity Write Up

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20 Questions: An Unplugged AI Adventure

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Actua is creating a Canada where every child has the skills and confidence they need to achieve their full potential. As a leading science, technology, engineering and mathematics (STEM) outreach organization, Actua includes over 40 universities and colleges, engaging 500,000 youth in 600 communities each year. For 25 years, Actua has focused on identifying and removing the barriers for entry into STEM and now have national programs dedicated to engaging Indigenous youth, girls and young women, Black youth, those facing economic barriers and youth in Northern and remote communities. For more information, please visit us online at www.actua.ca and on social media: Instagram, LinkedIn, Facebook and YouTube! For more information, please visit us online at www.actua.ca and on social media: Twitter, Facebook, Instagram and YouTube!

20 Questions: An Unplugged AI Adventure

Activity Summary

There are many ways we can try to make a machine complete a task. In this activity, participants will explore some of these strategies! Participants will begin building their knowledge by exploring how artificial intelligence makes decisions through a game of rock paper scissors. Participants will then create their own decision tree to classify Arctic animals.

Developed by Actua, 2025

Delivery Environment	Activity Duration	Intended Audience	Tech
In-Person	60 minutes	Grades 2-4 (*Ages 7-10*)	**Facilitators should have access to a laptop, projector, speakers, and a screen or blank wall to project onto.** • Projector • Speaker • Screen/Blank Wall • Laptops/Tablets

Achievement Goals

Learning Goals

Following this activity, participants will:

- **Understand** what an algorithm is and how to use one to complete a task.
- **Explore** how artificial intelligence can be used ethically and safely.
- **Use** algorithmic thinking to solve problems efficiently.

Success Criteria

Following this activity, participants can express:

- **I can explain** what an algorithm is and describe how it guides a machine to complete a task.
- **I can explain** how artificial intelligence makes decisions and talk about how to use it in ways that are safe, fair, and respectful.
- **I can create** a decision tree to classify Arctic animals based on different features.

Logistics (Timing, Group Sizing, Materials)

Section Title	Time	Group Size	Materials
Opening Hook	5 minutes	*Whole Group*	• N/A
Section 1: Rock, Paper, Decisions	15 minutes	*Individual or Pairs*	**Facilitators** • 20 Questions - Activity Slide Deck (*Appendix C*) **Per Pair or Individual** • Dice

Section Title	Time	Group Size	Materials
Section 2: 20 Questions	30 minutes	*Whole Group, Pairs or Small Groups (3-4)*	**Facilitators** • Animal Cards - Activity Set (*Appendix C*) • Chart Paper or Whiteboard • Marker **Per Small Group or Pair** • Animal Cards - Activity Set (*Appendix C*) • Chart Paper • Marker • Writing Utensil • Paper
Reflection & Debrief	5 minutes	*Whole Group*	• N/A

Safety Considerations

Safety considerations have been provided below to support safety during this activity, however they are not necessarily comprehensive. It is important that you review the activity and your delivery environment to determine any additional safety considerations that you should be implementing for the delivery of these activities.

Emotional Safety

- Facilitators should understand that participants have different lived experiences and prior knowledge about AI safety, AI, and digital citizenship. This activity may involve or lead to discussions of sensitive topics, such as ethical implications of AI. Facilitators should encourage open, respectful discussions and acknowledge all perspectives. Facilitators should always keep the participants' emotional safety in mind in these discussions, and defer to training from their institution and training received.

Curriculum Links

This activity aligns with these components found in the UNESCO AI Competency Framework for Students:

Ethics of AI: Embodied Ethics

- Learners are expected to be able to develop a basic understanding of the ethical issues around AI, and the potential impact of AI on human rights, social justice, inclusion, equity and climate change within their local context and with regard to their personal lives. They will understand, and internalize the following key ethical principles, and will translate these in their reflective practices and uses of AI tools in their lives and learning: Do no harm, Proportionality, Nondiscrimination, Sustainability, Human determination, and Transparency (p. 31-32).

AI Systems Design: Problem Scoping

- Learners are expected to be able to understand the importance of 'AI problem scoping' as the starting point for AI innovation. They are also expected to acquire the knowledge and project-planning skills needed in order to conceptualize and construct an AI system (p. 35).

AI Techniques and Applications: AI Foundations

- Learners are expected to develop basic knowledge, understanding and skills on AI, particularly with respect to data and algorithms, and understand the importance of the interdisciplinary foundational knowledge required for gradually deepening understanding of data and algorithms. They should also be able to connect conceptual knowledge on AI with their activities in society and daily life, concretizing a human-centred mindset and ethical principles through an understanding of how AI works and how AI interacts with humans (p. 32-34).

AI Techniques and Applications: Application Skills

- Learners are expected to be able to construct an age-appropriate knowledge structure on data, AI algorithms and programming, and acquire transferable application skills. (p. 41).

This activity can be connected to the following subject areas:

Science

- Observe characteristics of animals and their habitats to classify living things.
- Understanding the role of science and technology in society and daily life.

Mathematics

- Organize and represent information using appropriate formats or tools.
- Determining pattern rules and using them to make and justify predictions.
- Collecting, organizing, and interpreting qualitative and quantitative data.

Community Connections

Community connections are suggestions from Actua, grounded in our approach, on how facilitators can adapt the activity to reflect the strengths, interests, and priorities of the community where or with whom it is delivered. Consider the following guiding questions to adapt the activity in meaningful ways:

- **Consult with community:** Are there local organizations, Knowledge Keepers, or community members who could contribute insight or context to this topic?
- **Draw on youth experience:** How can you give participants opportunities to share, reflect on, and apply how this learning is relevant to them or their community? Invite participants to identify what knowledge, who, and where they already learn from.
- **Integrate local examples:** How can you tailor this activity to local or regional interests, industries, or community priorities (e.g. land and environment, health, technologies)?

Activity Procedure

To Do in Advance

SECTION	PREPARATION

General	• **Think ahead and be ready to adapt:**
	  ◦ Determine your **delivery method** and leverage ideas from the delivery recommendations and adaptations sections.
	  ◦ While **estimated times** are provided, it will be helpful to think about how much time you would like to spend on different activities and discussions.
	  ◦ While **group sizes** (individual, pairs, groups) are suggested, many activities are flexible for whatever will work in your classroom.
	• **Prepare for the content:**
	  ◦ Have **answers in mind** to share with participants for the various reflection questions asked.
	  ◦ Examine the provided materials to determine if they are **suitable** for your participants.
	• **Equipment:**
	  ◦ Ensure device, screen and projector are set up.

Section 1: Rock, Paper, Decisions	• Outline a clear playing area, double check that proper footwear is being worn.

Opening Hook

1. Ask participants: “Are you familiar with **Artificial Intelligence (AI**)?”
    a. Artificial Intelligence is the study of creating computer programs that can mimic different parts of human intelligence.
    b. AI allows machines to learn from experience.

2. Ask participants: "Can you think of any times you've **used AI or encountered it in your daily life**?"
    a. Generative AI (e.g. ChatGPT, Microsoft Copilot, and Google Gemini)
    b. Navigation Apps (e.g. Google maps)
    c. Digital Assistants (e.g. Siri and Alexa)
    d. Facial recognition (e.g. Phones)
    e. Smart home devices (e.g. Google Home and Alexa)
    f. Internet (e.g. Chat Bots and Ad Recommendations)
    g. Video Games (e.g. Non-Playable Characters)
    h. Social Media (e.g. photo filters)
    i. Community (e.g. Healthcare, Libraries, Transportation)
3. We can teach a computer to learn using many different methods, thus we are going to explore one way humans can teach machines to make decisions, with decision trees!

Section 1: Rock, Paper, Decisions

Human Versus Human

1. Ask participants to begin playing rock, paper, scissors with one another. When a participant loses a round they can observe participants still playing.
    a. Continue playing until most participants are back in the circle (about 2-3 minutes total playing time).
2. Ask participants: “How **many actions** did you have and **how did you decide which action** (rock, paper, or scissors) to use each round?”
    a. Participants are making a decision. We make decisions, big and small, everyday.
    b. Explain that we can teach computers to make decisions just like humans make decisions. A computer programmer is responsible for thinking of all the answers to one question and tells those to a computer. Then a computer can make a decision. This is called a decision tree.

Human Versus AI

1. Provide each participant a die, and present the second slide of the 20 Questions - Activity Slide Deck (*Appendix C*).
2. Explain that they will again be playing rock, paper, scissors, but this time they will each be playing against an "AI computer" (the decision tree on the screen).
3. For each round, participants need to decide who will play as the AI (using the decision tree on the screen), and who will be the human (making their own decisions).
4. Have participants count in the same way as if playing human vs. human. It will play out like the following:
    a. Both participants say: "rock, paper, scissors"
    b. On "scissors" the "human" participants will say their decision out loud, while the "AI" participant rolls the dice to know what the decision is.
5. Play a few rounds (about 2-3 minutes).

AI Versus AI

1. Gather as a group and explain that for the final round participants will be playing AI vs AI. Present the third slide of the 20 Questions - Activity Slide Deck (*Appendix C*) and show a different decision tree.
2. Every participant will be the AI for this round using the new decision tree to determine rock, paper, or scissors. Remind participants to roll the dice at the same time.
    a. When a participant loses a round they can rejoin the circle.
    b. Continue playing until most participants are back in the circle.
3. As a group discuss the following question:
    a. In all three versions there were only three possible outcomes, rock, paper, or scissors, but the way we got to the outcome was different. Which version of rock, paper, scissors did you find easiest to play? Why?
        i. While you can sometimes predict what a human will do, you can't predict what number the die will roll.
4. Present the third slide of the 20 Questions - Activity Slide Deck (*Appendix C*). Ask if they noticed anything about the AI decisions during the AI vs AI round.

    a. Does this decision tree make fair choices between rock, paper, scissors?
        i. No! This decision tree is more likely to choose rock than the other options.
        ii. When enough rounds are played, rock would be chosen about 50% of the time while the other 2 options will each be chosen 25% of the time.
5. As a group brainstorm ways to make the decision tree more fair.

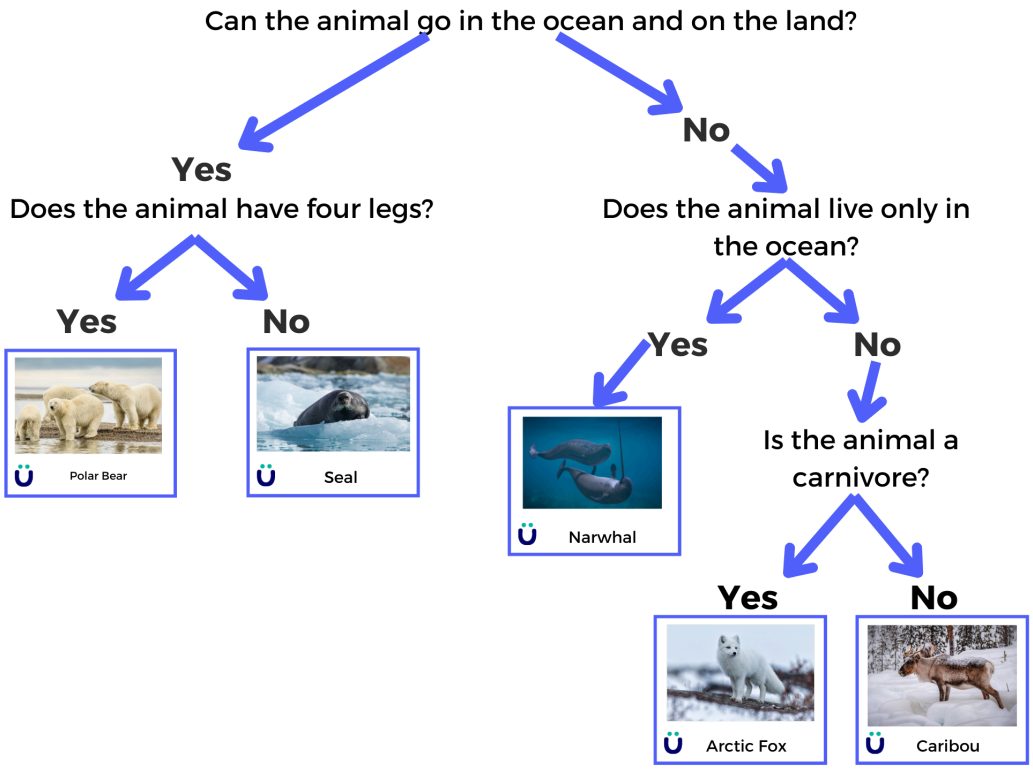
Section 2: 20 Questions

1. Encourage participants to share and reflect what they've learnt about artificial intelligence and decision trees so far!
    a. We learned about **decision trees** that are limited to three decisions, but we know machines/computers can do even more!
    b. Remind participants that not all decision trees are equal. When designing decision trees we need to take into account the chances of arriving at a decision.
2. For the next activity, explain to participants that you have selected an arctic animal from the Animal Cards - Activity Set (*Appendix C*). It's a secret and the only way to figure out the answer is by asking 20 yes/no questions.
3. Participants must work together to ask 20 questions to determine which arctic animal the facilitator selected.
    a. Other facilitators should guide the participants to select appropriate questions. Encourage participants to start with broad questions and then get more specific. Examples could include:
        i. Does the animal live only on land?
        ii. Is your animal a carnivore?
        iii. Does your animal have white fur?
    b. As participants ask questions, write them on a chart paper or whiteboard in the form of a decision tree with the answer.

4. Now have participants play 20 questions with each other.
    a. Ask participants to form small groups of 3-4 people. Provide participants with the Animal Cards - Activity Set (*Appendix C*), paper, and a writing utensil.
    b. One participant will be the “Secret Keeper” and the rest of the group will be the “Questioners”.
        i. The “Secret Keeper” will choose an animal.
        ii. The “Questioners” will take turns or work together to ask yes/no questions. One “Questioner” will also record the questions asked and the answer the “Secret Keeper” gives.
        iii. If the answer is not guessed in 20 questions the “Secret Keeper” wins!
    c. Have participants play a few rounds, switching the roles each time.
5. Gather participants to discuss the following questions.
    a. Ask participants: “Who was able to **guess the animal**? How **many guesses** did it take?”
    b. Ask participants: “What **went well** when asking questions? Were there **any strategies** you used?”
        i. Start with general questions then move to specific ones.
        ii. Build on previous questions.
        iii. It is important to break down the data (secret object) into simple questions.
6. Explain that participants are now going to create a decision tree that will be able to predict which arctic animal you have chosen, just like playing 20 questions. We want to find the smallest number of questions that can be used to identify each animal.
    a. The decision tree is becoming the “Questioner”
7. Ask participants to form small groups of 2-4 participants.
    a. Provide each group with chart paper and a marker, Have participants select anywhere from 2-6 animal cards from the Animal Cards - Activity Set (*Appendix C*) (there are 6 animals total to choose from).

b. Participants will create a decision tree that can accurately identify one of the animals in the decision tree. Remind participants to start with general questions and then get more specific.
    i. Is it a mammal?
    ii. Can it make loud noises?
    iii. Does it have 4 legs?
    iv. Does it live underwater?
    v. Is it a fish (/bear/bird/etc)?

8. Once participants have created their decision tree, it's time to test it out!
    a. Have participants work in their group, with one person following the "AI (decision tree)", and the others are the "Secret Keepers".
    b. Then have participants switch decision trees with other groups!
    c. Refer to the example below for one way the animals could be sorted.



Reflection & Debrief

1. Reflect on the previous activity with the following questions:
    a. Ask participants: “What **similarities, and differences** exist between the trees?”
    b. Ask participants: “Would any groups **change their tree** if given more time?”
2. Debrief the learning experience:
    a. Ask participants: “Can you think of any **tools or technologies** that might use a decision-tree-like process?”
    b. Ask participants: “What could go wrong if a decision tree follows rules that **aren't fair** or are **based on incorrect information**?”
3. Discuss the different careers listed in *Appendix A: Career & Mentor Connections*.

Delivery Adaptations

How might you adapt the time, space, materials, group sizes, or instructions to make this activity more approachable or more challenging? **Modifications** are ways to make the activity more accessible, **extensions** are ways to make the activity last longer or more challenging.

Modifications

SECTION 1: ROCK, PAPER, DECISIONS

- Play as a group for all AI rounds.

SECTION 2: 20 QUESTIONS

- Create 3 small groups, with one facilitator leading each group.
- Select only 2 animal cards from the Animal Cards - Activity Set (*Appendix C*).

Extensions

SECTION 1: ROCK, PAPER, DECISIONS

- Ask participants to keep a tally of which decision (rock, paper, or scissors) is chosen each round for all three levels.
- At the end of the section, ask participants to calculate the percentage that each option was chosen using the formula.
    - **Formula:** (# of time chosen / number of total rounds played) x 100 = % the decision was chosen.
- Ask participants to create a fairer decision tree than the one used during the AI vs. AI round
    - Encourage participants to be creative. Their tree doesn't need to use a dice, consider other options like flipping a coin!
    - ***Note:*** Avoid using the decision tree from the Human vs. AI round.

SECTION 2: 20 QUESTIONS

- Allow participants to select any item they want, this could be a person, place, or thing.
- Ask participants to make a few versions of their decision tree. Can they make it more efficient each time?
- Have participants select more than 6 animal cards, by making their own.

References & Gratitude

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Appendices

Appendix A: Career & Mentor Connections

COMPUTER PROGRAMMER

- A computer programmer is a person who creates computer software. They write code to build websites, computer games, financial analysis and many more

MATHEMATICIAN

- Mathematicians use extensive knowledge of mathematics to solve problems concerning numbers, patterns, algorithms, data, quantity, etc.

SOFTWARE ENGINEER

- Software engineers design and develop computer software. They are often fluent in multiple programming languages, such as Python, Javascript or Swift.

Appendix B: Background Information

COMPUTATIONAL THINKING AND ALGORITHMS

As is described by its name, computational thinking is an approach and a way of thinking. It is structured and systematic and therefore lends itself well to computer science. However, computational thinking is useful beyond computer science as an approach to learning and problem solving. The four stages of computational thinking are:

- **Decomposition:** Breaking down the information into manageable parts.
- **Pattern Recognition:** What is the data doing?
- **Abstraction:** Identifying the rules that dictate the observed patterns.
- **Algorithm Design:** Developing the steps to solve the problem.

An **algorithm** is a set of steps to be taken in order to complete a task. Think of it like a recipe: a set of precise steps that, if followed correctly, will lead to a desired outcome, whether it's baking a cake or sorting a list of names.

In computer science, these are created with a programming language (a language that a computer can understand) in order to input commands and write complex programs. They are the logical blueprints that tell computers how to do things. Algorithms make up our search engines (like Google), our GPS systems, the video games we play and even control our homes.

ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) is a branch of Computer Science that deals with a machine's ability to simulate intelligent behaviour. This includes cognitive functions we associate with human minds, such as perceiving, reasoning, learning, and adapting.

AI is becoming increasingly vital in our lives. From digital assistants, GPS navigation, and autonomous vehicles to tools like Siri/Google Home and generative AI tools (e.g., OpenAI's Chat GPT), its impact on our daily lives is growing. AI plays a crucial role in various aspects of work, enhancing efficiency, and taking on hazardous or

monotonous tasks. As AI applications grow, discussions on AI ethics and responsible practices are increasingly important.

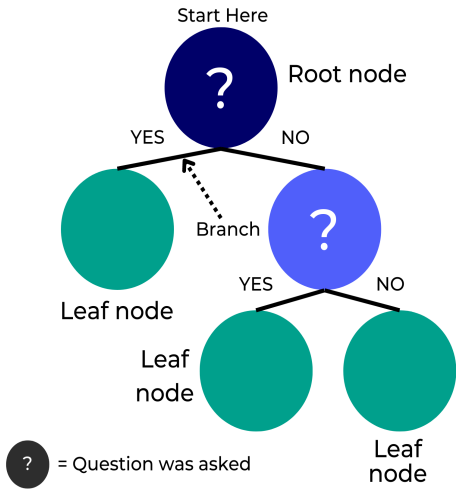
General and Narrow AI

Narrow AI (or specific intelligence) refers to an AI or intelligence that can only do one particular task. A chess-playing computer, a Spotify playlist generator, or a calculator are all examples of specific intelligence. They can do one task very well, but if you asked a chess-playing computer to drive you to work, it would probably end in an accident. Even an advanced computer like IBM's Watson is an example of narrow AI; it is only good at one thing, beating humans at Jeopardy.

General intelligence or general AI is intelligence that is more human and much broader. Something with general intelligence could use its intelligence to solve any problem it was faced with. A human being can play Jeopardy, but can also drive themselves home and cook themselves dinner. General intelligence can learn from their environment and experiences and apply those lessons to different environments and experiences.

Today, we have only created machines capable of narrow intelligence. However, many scientists and engineers are working on creating general intelligence for future use.

Decision Trees



A decision tree is structured as an upside-down tree. The top of a decision tree is called the "root" or "root node". Questions are asked at nodes, so this is where the first question is asked. From the root, there are two branches, each representing an answer to the question, and at the end of each of these branches is another node. When there are no more questions to ask at a node, no branches get added and that node is called a "leaf". While the decision tree questions that are asked can have multiple answers, most often they are binary, i.e. there are only two possible answers that the data can fit into.

Appendix C: Additional Resources

GENERAL

Activity Slide Deck

- 20 Questions - Activity Slide Deck
    - ***Note:*** This link will automatically download to your device.

SECTION 2: 20 QUESTIONS

Activity Material(s)

- Animal Cards - Activity Set (refer below)

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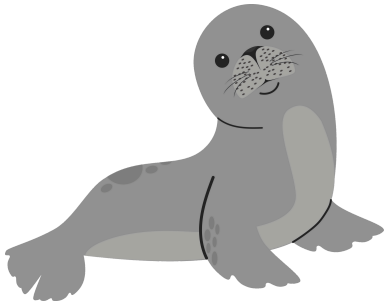
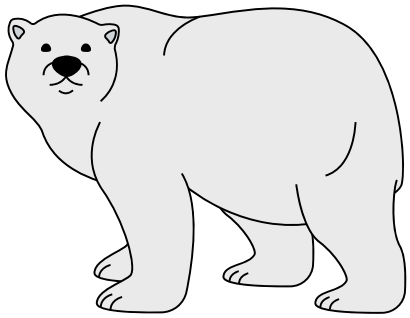
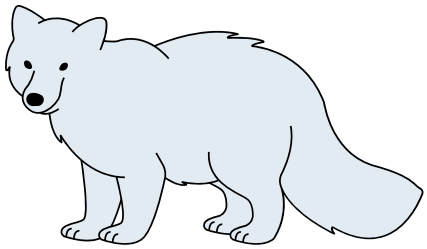
Animal Cards



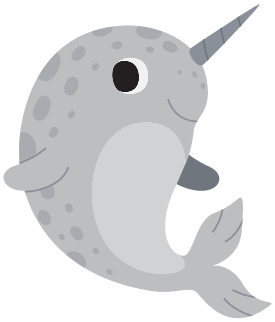
Seal



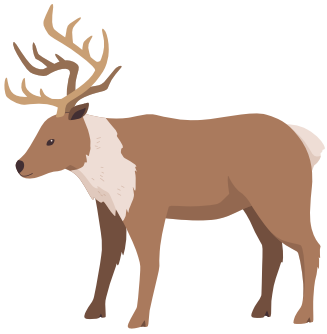
Polar Bear



Arctic Fox



Narwhal



Caribou

Muskox