INSTRUCTIONAL PLAN

Name: Gary Malkasian	**Grade: 11-12**
Date: Nov. 1, 2024	**Unit/Subject: IB Computer Science (Java)**
Lesson Title/Focus: Binary Numbers	**Number if Part of a Series Lessons: _____ of _____**

Learning Target(s)

Long-term Learning Goal(s) (i.e., teacher goal for unit or learning segment): Prepare for the International Baccalaureate (IB) Computer Science Standard Level (SL) exam. The IB Comp Sci SL requires the students to know, understand, be able to apply, and be able to communicate:
• System fundamentals
• Object-oriented programming (OOP) (selected elective)
• Computer organization
• Networks
• Computational thinking, problem-solving and programming

State Academic Learning Standards (Common Core State Standards / NextGen, etc.):

The IB Comp Sci SL objectives
Binary representation
2.1.9 Define the terms: bit, byte, binary, denary/decimal, hexadecimal.
2.1.10 Outline the way in which data is represented in the computer.

Common Core: Reading Standards for Literacy in Science and Technical Subjects 6–12
Key Ideas & Details
Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.

Craft & Structure
Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–12 texts and topics.

OPSI Computer Science K-12 Standards
2-AP-11 Create clearly named variables that represent different data types and perform operations on their values.

Learning Target(s) for this Lesson: (in kid-friendly language): Understand how different number bases work, and how to convert between decimal, binary, octal, and hexadecimal number representations.

Academic Language explicitly taught in this lesson – vocab, language function (processes such as explain, describe, analyze), syntax, discourse
Academic Language taught: Java, binary, decimal, octal, hexadecimal, converstion, number bases, algorithm, computer science, Internet, model, digital, system, programming, machine language, assembly language, low level programming, and high level programming languages.
Academic Language Supports (charts, handouts, videos etc.): handout and worksheet

Personal, Cultural or Community Asset Connections
Plan (what will I do to connect the target(s) to students and how?): Students are in the International Baccalaureate program studying Computer Science classes. A high percentage of them have parents who work in high tech. A good number are interested in continuing in math and sciences. Understanding Binary/Hexadecimal numbers is fundamental to Computer Science studies. Even those who don't may be interested to learn that computers "think" in binary – they are all consumers of computer technology. I will point out these connections, and that what they learn today will be used in future Computer Science class, including programming, algorithms, networking, and computer architecture classes, the last of which is where they really study how a computer processes information "thought-by-thought", so to speak.

Background Knowledge
How will I activate background knowledge? The decimal system is what they learned in elementary school. They learned concepts of grouping, exponential powers, and logarithms. We humans developed the decimal system as base 10 because we have 10 fingers; it's our natural way to count. Computers have the binary system because they think in terms of "ON" and "OFF", or 1s and 0s. I will make the connection between how we group in decimal and how we group in binary. From there I will extend to octal and hexadecimal.
How will I fill prior knowledge gaps? The lesson will start with a review of grouping in decimal and exponential powers. This should be easy math for most, if not all of them. There will be lab time to work on the worksheet, during which time I will circulate around the room to see who needs help.

Addressing "the hard part"
What will be the "hard part" for kids about this learning target(s)? Possible misconceptions? The difficulty is not the concept itself but the practice of conversion between decimal, octal, and hexadecimal.
How will I address that "hard part" (what will I do and how?) There will be a game with teams competing to convert numbers, giving students supported practice. Students who are unsure can rely on their teammates, and at the same time have a tactile learning method after the lecture and before doing the worksheet. I will help those having difficulty with the worksheet during lab time.

Instructional Materials, Resources, and Technology Needed to Present this lesson
Large posterboard squares each with a 0 or 1 for students to hold. These are the game pieces; a set is one "1" and one "0".

Instructional Plan to Deepen and Extent Student Understanding: Teacher Tasks (steps of the lesson) and Student Learning Behavior (what you'll see)-Teacher Will or Student Will (TW or SW)- Start with an Action Word
TW greet students as they enter the class. As it is 1st period, after the bell rings we will have announcements and Pledge of Allegience. TW welcome the class and introduce the purpose of the lesson: to understand the binary, octal, and hexadecimal numbering systems and how to convert between them. Students should already have the handout. TW verify. TW review the decimal system of grouping, the historical connection to having 10 digits, and how binary is the way computers "think". Octal and Hexadecimal are "compromises", easier for humans to work with than long binary strings but still easy to convert to binary and back. TW explain the meaning of binary strings, give examples, and give students who've already caught on the opportunity to assist the teacher in working the examples. TW will also explain conversion to octal and hexadecimal. Game: Four student volunteers will come up front and each be given a set of game pieces, a "1" and "0". The group of four will cooperatively convert a decimal number of 15 or less into a four-bit binary number by holding up a "1" or "0". After they succeed, a new group of four volunteers will do it, too. Now that the method has been demonstrated, the room will be divided into two teams. Each team sends 4 players up at a time. The two sides compete to be the fastest to convert a decimal number into binary. We will go several rounds and declare one side to the winner. Now we will ask the two sides to send up their "all stars" – four players each – to *cooperatively* convert a number less than 256 into an eight-bit number just to see how fast they can do it. SW return to their seats. Students will be given the worksheet and and spend the remainder of the time filling it out. TW circulate and assist those who need extra help. "All stars" who finish early may volunteer to help their peers. SW turn in worksheets before they leave or as allowed by accommodation.

At the end of class, TW thank the students and wish them a good weekend as they leave.

Accommodations/Modifications Needed for Individual or Diverse Learners

Support Plan (what will I do and how?) Out of 26 students, 3 have 504 plans and 1 has an ELL designation. Accommodations allow flexibility in turning in assignments. Students will get 1:1 help as needed.

Supports for specific special needs students for this specific target(s):   (charts, manipulatives, handouts) for all students the lecture will include visual explanations on the whiteboard and a tactile representation of bits they will cooperatively manipulate.

Assessment Strategies: Assessing the Impact of the Instruction on Student Learning

Proposed evidence (Student work, skills, performance) team scores from competition and the student's individual completed worksheet.	Evaluation Criteria (What will tell me students have "met standard, etc.")? Student is able to correctly convert between decimal, binary, octal, and hexadecimal.
Plan to give students feedback: Class will discuss the correct answers. TW return graded sheets.	How student will use your feedback (revise work, additional practice, etc.): students can revise their worksheets