



Name: _____

Date: _____

Class: _____

John von Neumann & Computer Architecture

Modern Computing Worksheet Series

John von Neumann (1903–1957) was a Hungarian-American mathematician, physicist, and polymath who is widely considered one of the greatest scientific minds of the 20th century. Known for his photographic memory and ability to perform incredibly complex mathematical equations in his head, von Neumann made major contributions to quantum mechanics, game theory, and economics. However, his most lasting physical legacy is the blueprint he created for the modern computer.

During World War II, von Neumann worked on the Manhattan Project. This project required massive, complex calculations that were incredibly tedious to do by hand. He became involved with the team building the ENIAC, one of the world's first electronic general-purpose computers. While ENIAC was a marvel, it had a major flaw: if you wanted it to perform a different type of calculation, engineers had to physically unplug thick cables and rewire the entire machine by hand, a process that could take days.

In 1945, while consulting on a newer computer called the EDVAC, von Neumann wrote a paper titled "First Draft of a Report on the EDVAC." In it, he described a revolutionary idea known as the "stored-program concept." He proposed that a computer's instructions (the software program) and the data it was processing should both be stored electronically in the same memory space. This meant a computer could be reprogrammed simply by uploading new code, without needing to physically rewire the machine.

This design, now universally known as the "von Neumann Architecture," broke the computer down into three main components: a Central Processing Unit (CPU) to perform math and control operations, a single Memory block to store data and instructions, and Input/Output (I/O) mechanisms to interact with the user. It is difficult to overstate the importance of this blueprint. Today, almost every digital device on the planet—from the smartphone in your pocket to the laptop on your desk to the servers running the internet—still fundamentally relies on the von Neumann architecture.

PART 1: MULTIPLE CHOICE

Circle the letter of the best answer.

1. Before von Neumann's stored-program concept, how did engineers reprogram early computers like the ENIAC?

- A. By typing new commands into a keyboard.
- B. By downloading new software from a network.
- C. By physically unplugging cables and rewiring the machine.
- D. By replacing the computer's battery.

2. What is the core idea behind the "stored-program" concept?

- A. The computer's instructions (software) and data are stored together in the same electronic memory.
- B. Programs are stored on punch cards and fed into the machine one by one.
- C. The computer stores programs in a separate, physical vault to keep them safe.
- D. Data is deleted immediately after a program finishes running to save space.

3. According to the von Neumann Architecture, which component is responsible for actually performing the math and controlling operations?

- A. The Memory
- B. The Central Processing Unit (CPU)
- C. The Input/Output (I/O) mechanisms
- D. The Internet

PART 2: SHORT ANSWER

Write your answers in complete sentences based on the reading passage.

4. List the three main hardware components that make up the von Neumann Architecture.

5. Why is the 1945 paper "First Draft of a Report on the EDVAC" considered one of the most important documents in computer history?

PART 3: CRITICAL THINKING

6. John von Neumann was a "polymath"—someone whose expertise spans a significant number of different subject areas (physics, math, economics, and computer science). Today, society often encourages students to "specialize" in just one specific career path. What might be the advantages of having broad knowledge across many different fields like von Neumann did when trying to invent new technologies?
