AH WATSON YOU’VE COME.
WE NEED TO GO HELP MYCROFT
ARTICULATE THE INTUITION BEHIND
HIS LATEST DISCOVERY.

WHAT DO YOU MEAN
“WHAT IS AN INTUITION”? 
Suppose you have come with a solution* to a problem.

And now, you have to explain how it works.

\[ N = \sum K_i = (F_0 N + \varepsilon_0) + \ldots + (F_r N - \varepsilon_r) = N \sum_{i=1}^r F_i + \sum_{i=1}^r \varepsilon_i = \sum_{i=1}^r F_r \varepsilon_i \]

\[ \Rightarrow \sum_{i=1}^r \varepsilon_i = \sum_{i=1}^r F_r \varepsilon_i \]

*an algorithm, approach, process, heuristic, technique, etc

But if it's not, then consider giving the "intuition" before diving into the technical details of your algorithm.
THE REASON BEHIND WHY IT WORKS...

THE PRINCIPLE AT PLAY...

THE ESSENCE.

YOU SEE WATSON, THE INTUITION IS THE MAIN IDEA BEHIND HOW THE SOLUTION WORKS...

IT CAN PROVIDE A LESS TECHNICAL AUDIENCE WITH A NEEDED STEPPING STONE FOR UNDERSTANDING THE TECHNICAL SPECIFICS OF YOUR SOLUTION;

IT CAN PROVIDE A TECHNICAL AUDIENCE WITH A SANITY CHECK FOR THEIR UNDERSTANDING

IT CAN EVEN PROVIDE YOU WITH MORE INSIGHT INTO YOUR OWN SOLUTION!
FOR EXAMPLE, FOR RECURSION, THE INTUITION MIGHT BE:

"YOU CAN SOLVE A COMPLEX COMPUTATIONAL PROBLEM BY REDUCING THE PROBLEM TO A SMALLER, EASIER INSTANCE OF THE SAME PROBLEM, SUCH THAT AN ANSWER TO THE EASIER PROBLEM YIELDS AN ANSWER TO THE ORIGINAL."

TAKE FOR INSTANCE FACTORIAL...

N! IS EXPRESSED AS SOMETHING SMALLER THAT LOOKS LIKE IT - NAMELY, ANOTHER FACTORIAL BUT FOR N-1

\[ N! = (N-1)! \times N \]

IF YOU KNOW WHAT (N-1)! IS, THEN YOU CAN MULTIPLY BY N TO COMPUTE THE ORIGINAL DESIRED VALUE, N!
LET'S LOOK AT FOUR MORE EXAMPLES

THE CASE OF THE RUNAWAY REPLICATION OF DNA

PROBLEM (WHAT):
Efficiently replicate DNA to obtain a super-linear number of copies after a linear number of cycles.

SOLUTION:
Polymerase Chain Reaction (PCR)

INTUITION (HOW):
Replicate all the DNA strands each cycle - i.e. the original two and all newly created strands so far are used as templates for further replication so that the number of strands doubles each iteration.

DETAILS OF THE PCR REACTION (LIKE PRIMERS, POLYMERASE, NUCLEOTIDES AND THERMAL CYCLING) WOULD BE SAVED FOR ANY ENSUING EXPLANATION.

NOTICE THAT AGAIN, I KEPT THE INTUITION HIGH LEVEL.
THE CASE OF THE BULLET FROZEN IN MID-FLIGHT

PROBLEM (WHAT):
PHOTOGRAPH HIGH-SPEED EVENTS THAT HAPPEN IN THE BLINK OF AN EYE (SUCH AS A BALLOON POPPING OR A BULLET MID-FLIGHT)

SOLUTION:
STROBE PHOTOGRAPHY

INTUITION (HOW):
INSTEAD OF FIXING THE LIGHTING AND OPENING A MECHANICAL SHUTTER (WHICH IS SLOW), REVERSE IT; KEEP THE MECHANICAL SHUTTER OPEN AND FLASH A LIGHT (WHICH IS FAST)

FOR THIS INTUITION, I THOUGHT IT MIGHT BE HELPFUL TO CONTRAST THE SETUP FOR STROBE PHOTOGRAPHY WITH SOMETHING PEOPLE SHOULD ALREADY BE FAMILIAR WITH TO HIGHLIGHT THE DIFFERENCE.
THE CASE OF THE BULLET PROOF IN MID-FLIGHT

PROBLEM (WHAT): Photographic high-speed events happen in the blink of an eye (duct tape)
SOLUTION: Trouble photography

SITUATION (HOW): For purposes of flash, the lighting and back is slow. Reverse it, keep the charge feeder, keep the flash

THE CASE OF THE MISSING ADDRESSES

PROBLEM (WHAT): Internet devices need a unique IP address in order to communicate, but if every device gets its own permanent IP address, there aren’t enough of them to go around.
SOLUTION: Network address translation (NAT)

INTUITION (HOW): Address reuse - set aside a small pool of addresses that can be temporarily assigned to any device that needs to communicate. When the device is done communicating, the address is returned to the pool so that it can be later assigned to another device.

THIS IDEA OF REUSE MIGHT BE ENOUGH FOR SOME AUDIENCES TO GET THE GIST;

FOR OTHERS, I MIGHT INSTEAD CHOOSE TO USE SOMETHING MORE CONCRETE – NAMELY, THE ANALOGY OF A “POST OFFICE BOX”.

POINT IS I COULD USE DIFFERENT INTUITIONS FOR DIFFERENT AUDIENCES.
THE CASE OF THE OUT-OF-MEMORY PROBLEM

PROBLEM (WHAT):
RECLAIM UNUSED COMPUTER MEMORY FOR REUSE (I.E. GARBAGE COLLECTION OF HEAP MEMORY THAT CAN BE DYNAMICALLY ALLOCATED BY A COMPUTER’S OPERATING SYSTEM)

SOLUTION 1:
MARK AND SWEEP ALGORITHM

INTUITION 1: (HOW)
IT’S LIKE WHEN YOU ARE USING A BLACKBOARD AND RUN OUT OF SPACE. YOU CAN MAKE SPACE BY FIGURING OUT WHICH THINGS ON THE BOARD YOU NEED TO KEEP AND ERASING EVERYTHING ELSE

SOLUTION 2:
STOP AND COPY ALGORITHM

INTUITION 2: (HOW)
IT’S LIKE WHEN YOU ARE USING A BLACKBOARD AND RUN OUT OF SPACE, YOU CAN MAKE SPACE BY (1) FINDING A SECOND CLEAN BLACKBOARD, (2) COPYING ALL THE THINGS ON THE FIRST BOARD THAT YOU STILL NEED OVER TO THE SECOND BOARD, AND THEN (3) USING THE SECOND BOARD.

WHEN MULTIPLE SOLUTIONS EXIST FOR THE SAME PROBLEM, THEY HAVE TO DIFFER FROM EACH OTHER, IN SOME WAY.

THAT DIFFERENCE SHOULD SHOW UP IN THE INTUITION.

WAIT, DID YOU JUST PERFORM MARK AND SWEEP ON THE BLACKBOARD JUST A FEW PAGES AGO?
SO WATSON, I HOPE YOU SEE HOW USEFUL THE INTUITION CAN BE AND HAVE A FEEL FOR WHAT ONE MIGHT LOOK LIKE.

IT CAN SOMETIMES BE DIFFICULT TO EXPRESS, BUT IT IS WELL WORTH THE STRUGGLE.

TIME TO USE YOUR NEWFOUND SKILL!

QUICKLY WATSON.

THE GAME IS AFOOT!