

COMPLEXITY AND THE BIG-O NOTATION

SO YOU'VE WRITTEN SOME CODE

THE NATURAL QUESTION THEN IS...

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HOW PERFORMANT IS YOUR CODE?

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THIS IS A VERY COMMON QUESTION -
IN THE REAL WORLD AS WELL AS IN
INTERVIEWS

THE ANSWER LIES ALONG SEVERAL AXIS

PERFORMANCE IS MEASURED ALONG
RESOURCE CONSUMPTION AND CODE
CONSUMES A VARIETY OF RESOURCES

IMPROVING CODE PERFORMANCE BEYOND A
CERTAIN POINT INVOLVES TRADEOFFS

CONSUMING MORE OF ONE RESOURCE
CAN HELP CONSUME LESS OF
ANOTHER

MEASURES OF PERFORMANCE

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TIME

THE AMOUNT OF PROCESSING
OR NUMBER OF OPERATIONS
CODE HAS TO PERFORM TO
ACCOMPLISH IT'S OBJECTIVE

SPACE

THIS IS BOTH MEMORY NEEDED
BY CODE TO STORE
INFORMATION AT RUN-TIME
AS WELL AS DISK SPACE
NEEDED BY CODE FOR
PERSISTENT STORAGE

NETWORK

THE BANDWIDTH CODE USES TO
PASS INFORMATION TO CLIENTS
OR OTHER MACHINES

PERFORMANCE INDICATES
HOW MUCH OF THESE
RESOURCES THE CODE USES

EFFICIENT CODE USES
FEWER RESOURCES
ALONG ALL THESE AXES

CODE CAN ALSO BE MORE
PERFORMANT WHEN IT USES
THE RESOURCES WE HAVE IN
PLENTY RATHER THAN THOSE
WE LACK

NOW THAT WE KNOW WHAT
PERFORMANCE MEANS

WHAT IS COMPLEXITY?

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COMPLEXITY IS A MEASURE OF HOW
RESOURCE REQUIREMENTS CHANGE
AS THE SIZE OF THE PROBLEM GETS LARGER

COMPLEXITY AFFECTS PERFORMANCE

THE HIGHER THE COMPLEXITY
OF A PROBLEM THE LOWER THE
PERFORMANCE

THE EXACT RELATIONSHIP
DEPENDS ON THE ALGORITHM

BUILDING BLOCKS

THE TIME REQUIRED BY CODE TO
RUN DEPENDS ON THE BASIC
OPERATIONS IT PERFORMS

ARITHMETIC OPERATIONS
ASSIGNMENT READ
TEST WRITE

ALL COMPLICATED OPERATIONS IN CODE
CAN BE BROKEN DOWN TO THESE BASIC
BITS

TO GET A CLEAR UNDERSTANDING OF COMPLEXITY

DO NOT WORRY ABOUT THE
EXACT NUMBER OF
OPERATIONS

THAT IS HOW
PERFORMANCE CHANGES
BASED ON INPUT SIZE

HOW THAT NUMBER CHANGES
BASED ON THE INPUT SIZE

WE ALSO FOCUS ON THE WORST CASE
PERFORMANCE

WHAT IS THE MAXIMUM NUMBER OF BASIC
OPERATIONS THAT MIGHT HAVE TO BE
PERFORMED BASED ON THE INPUT?

A QUICK SUMMARY OF EVERYTHING SO FAR

CODE USES TIME, SPACE AND
NETWORK RESOURCES

THE AMOUNT OF RESOURCE USED
DETERMINES CODE'S PERFORMANCE

COMPLEXITY IS A MEASURE
OF PERFORMANCE

COMPLEXITY IGNORES ACTUAL
OPERATIONS IN CODE AND FOCUSES
ON HOW THAT CHANGE BASED ON
INPUT SIZE

WE'RE FOCUSING ON TIME COMPLEXITY IN THESE
LECTURES WHICH ARE A FUNCTION OF THE ALGORITHM