Inquiry 1: Algorithm analysis, algorithm correctness, and distributed algorithms

Algorithms are only as effective as their parameters and available resources allow them to be, so in order to determine the amount of time, storage, and other resources necessary to execute an algorithm, the algorithm is analyzed. Analysis is an essential step in the process of creation and implementation. Analysis can also be used to verify an algorithm's correctness prior to full implementation. Verification of correctness is particularly important in distributed algorithms because their complexity can make implementation in real world distributed networks problematic.

A distributed algorithm is an algorithm that is designed to run on a complex system of autonomous, interconnected hardware. In a common sensor network, for example, an array of nodes must work together to accomplish a task and a distributed algorithm is the best way of achieving this because it is likely that not every node in the network can communicate directly with the base node and thus must utilize other nearby nodes as relays. Distributed systems running distributed algorithms are appealing for a number of reasons including their speed, their ability to preserve the global functionality of a system in the case of localized crashes, and their ability to adapt to environmental changes.

Algorithm analysis ensures that distributed algorithms will work as intended and is of particular importance in large, complex distributed networks because use of an inefficient algorithm can significantly impact performance of the network, drastically affecting the amount of computing power and time needed for algorithms to run. While these issues may not have much of an effect in smaller applications, in larger distributed networks inefficiencies can have especially far-reaching consequences as the scale of the network amplifies the effects of errors. For example, Intel's efforts to reduce errors in their chips involve countless algorithms running across a network of processers and it is essential that those algorithms are properly analyzed and implemented as any errors or inefficiencies will likely cost the company billions of dollars. For this reason, Intel strives to ensure total correctness in their algorithmic processes.

Distributed algorithms are very powerful tools for shaping the networks of the modern world but careful planning must be exercised in their implementation. Algorithm analysis that ensures correctness and efficiency is a necessary part of applying the theory of distributed algorithms to practical applications.

Inquiry 2: The Potential of Robotics in a Corporate Environment

As a maintenance contracts analyst, I am responsible for generating quotes for our sales representatives that comply with company policy and accurately reflect the assets for each customer. Most of the tasks required of the position are repetitive and relatively simple and are thus ripe for automation. However, as it can when implementing an abstract distributed algorithm, reality presents difficulties when attempting to automate elements that can and should be automated. Byzantine organizational bureaucracy, convoluted existent data structures, frequently changing procedures, and obfuscated and compartmentalized institutional knowledge can all impede the implementation of robotics that aim to help our team to be more efficient. Additionally, to make things even more difficult, our company recently went through a merger that has necessitated the merging of two enormous databases. A research-based approach is the best way to determine how these issues should be navigated.

The team tasked with automating many of our activities has been interviewing us as part of its effort to design macros that perfectly mimic our interactions with database-related software. I believe this approach is inefficient as the software via which we access the data is itself inefficient and cumbersome. It has been decided that adhering to existent procedures will allow for a smoother implementation but I disagree with this strategy. A research-based approach

wherein the team investigated data relationships thoroughly in order to create algorithms to manipulate and access those data directly would allow the robots to bypass archaic human-facing software and save a great deal of time and effort. Essentially recording out mouse clicks and keystrokes seems like a roundabout way of automating many of the tasks.

Robotics will soon make many elements of my job much easier, freeing me up to spend more time on tasks that are much more difficult to automate. Such tasks include particularly intricate quote customizations as well as in-depth research in cases where our data are not as clean as we would prefer them to be. Much of my day is spent on the latter, researching the status of and relationship between customer assets. An algorithmic, researched-based approach to sorting through our data would eventually lead to a database full of reliable data, saving countless hours of manual searching and cataloging as our robots became better and better at both cleaning data upon its entrance to the system and revising old asset records to meet current standards.

A research-based approach could also be utilized to improve my team's most repetitive interactions with computers. For example, currently in order to ensure that each nested asset is properly connected to its parent asset we often have to manually enter the serial number into a field for each nested asset. This must happen for sometimes hundreds of contracts per quote and can take days or even weeks. This extremely tedious task could be easily eliminated if research were done regarding the relationships between these assets on the back end, or if some sort of macro could be designed to run at our discretion within our access interface. Additionally, robots could learn our tendencies and anticipate our needs, enabling much more intuitive and efficient interactions. Just a bit of research into aspects of the most inefficient and mind-numbing activities workers must engage in to follow proper procedures would go a long way toward drastically improving things.

Given that the company I work for is so large and its data infrastructure so vast, its databases are especially enormous and labyrinthian. The size of the databases creates many issues, of course, but their scale also represents the perfect opportunity to utilize algorithmic processes to streamline information retrieval and clean up existent data. If properly written, such algorithms could revolutionize the way our team performs its duties and interacts with its customers, and greatly improve the overall quality of our work.

My company is in some ways already implementing a research-based approach to solving many of its problems but there are a few areas in which it could stand to enhance its approach. As we improve our capabilities regarding robotics and artificial intelligence we will be able to make human-computer interactions much more impactful while better organizing our data and eliminating many tedious tasks, paving the way for a much more efficient future.