

# Tuff Torq — Screening Questions

Candidate: Arjan Gupta

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- **Question 1:** Can you tell me about your relevant experience for this position?

- **Answer:** Absolutely. First off, I have a Bachelor's degree in Computer Engineering from the University of Kansas, and 6+ years of experience as a software engineer. I am also working towards a Master's degree in Robotics Engineering from Worcester Polytechnic Institute, with a specialization in autonomous vehicles.

My current position involves building a semi-autonomous motion system for an enormous agricultural machine called an irrigation pivot. I improve the system's ability to navigate the field including path planning, GPS dead-reckoning, and obstacle detection using on-board sensors. I mainly do this by writing C/C++ code for a complex embedded system on the machine. I write test scripts for the system in Python.

Furthermore, in my Robotics Master's degree program, am working with a variety of robotics frameworks and libraries including ROS2, Gazebo, and TensorFlow. I am developing machine learning, deep learning, and reinforcement learning for both academic and personal projects. Here, I use Python extensively.

I am also a Co-founder of a very early-stage company where I use PyTorch, OpenCV, and YOLOv7 to help daycare workers keep track of children that might have been left unattended. In this position, I write Python and JavaScript.

Other notable and related experience includes my work with biometric facial recognition systems, which relied on a pipeline of computer vision and machine learning algorithms. Also, at a previous company, I have contributed to the 3 degree of freedom (DOF) motion planning of a robotic arm that used a LiDAR sensor to estimate the volume of grain in a silo.

- **Question 2:** What Specific Skills do you possess that make you a strong candidate for this role?

- **Answer:** I have a strong background in software engineering and robotics. I am able to write C, C++, and Python code proficiently to develop software for various applications.

I am comfortable with designing and implementing machine learning models, neural networks, and reinforcement learning algorithms. I can solve vision and path planning problems using OpenCV and ROS2. Because of my Master's program, I am familiar with SLAM (Simultaneous Localization and Mapping) techniques. Because of my experience in embedded systems, I have a strong understanding of sensors and sensor fusion.

I am well-versed in using Git for version control, writing requirements and design documents, and writing unit tests for my code. I also mentor junior engineers and interns, and I am comfortable communicating with both technical and non-technical stakeholders.

- **Question 3:** How do you approach problem solving or handling challenges in the workplace?

- **Answer:** I approach problem solving by first understanding the problem and its context. For example, if I am tasked with debugging a GPS dead-reckoning algorithm, I would first understand how the algorithm is being used on the system as a whole. I would collect information about the problem by asking what the unexpected and expected behaviors are. Then, I would formulate a hypothesis about the problem and test it. If the hypothesis is incorrect, I use what I've learned in testing the system so far to formulate a new hypothesis, and then repeat the process.

However, sometimes the problem is not well understood, and the challenge is to understand the problem itself. In this case, I would use a similar approach, but I would also do research to understand the problem better. Sometimes this can involve studying a technology or sub-field of engineering that I am not familiar with. However, when I am comfortable with a certain level of understanding, I re-assess the problem and formulate a hypothesis on where to look next.

- **Question 4:** Can you provide an example of a project or accomplishment you are proud of?

- **Answer:** I am proud of my work on the irrigation pivot project where I built a semi-autonomous motion system for an enormous agricultural machine. I collaborated with other engineers to build many

parts of this system. I wrote drivers for sensors and the network stack, so that information about the system could be communicated to the control system. I heavily improved the motion planning algorithm, which involved writing a path planner that can intelligently decide when to energize the motors to move the machine. This takes into account checking relays, checking the state of the machine, and checking the state of the motors. A mapping of the field is also used to determine the best path to take. Furthermore, I also wrote a GPS dead-reckoning algorithm that can estimate the position of the machine when GPS is not available.

- **Question 5:** How do you stay updated and continually improve your knowledge and skills in your field?

- **Answer:** I have several ways of keeping my knowledge current. First of all, I am currently pursuing a Master's degree in Robotics Engineering, so taking new courses is one way I continually improve my knowledge and skills. However, my desire to learn new things extends beyond the degree. I have taken Coursera courses on machine learning and deep learning, and I have also taken Udemy courses on YOLOv7 and YOLOv8. I also read research papers on a variety of topics, including reinforcement learning, robot dynamics, and computer vision. My sister is also a PhD student in Neuroscience, so I often discuss research papers with her, even if they are not directly related to my field.

- **Question 6:** Describe a situation where you had to work collaboratively as part of a team to achieve a goal.

- **Answer:** I have a few examples of working collaboratively as part of a team, but I will use the instance where I worked with a team of engineers to build a 3 degree of freedom (DOF) robotic arm that uses a LiDAR sensor to estimate the volume of grain in a silo.

I was responsible for relaying the point cloud data from the LiDAR sensor so that it can be transmitted to the cloud via the cellular network on-board. I collaborated with a senior firmware engineer to retrieve information from the CAN bus interface for the LiDAR sensor. I also helped with the motion planning of the robotic arm where it needed to perform a sweep of the silo to estimate the volume of grain. Here, the simulation was done with a senior mechanical engineer, so we used the path planned by the simulation to implement the motion planning algorithm. This involved PWM control of the motors, as well as sensing the angles of the motors. We also collaborated with an electrical engineer to bring up the PCB for the robotic

arm, and tested the PCB with the motors and sensors.

- **Question 7:** How do you prioritize your work and manage your time effectively?

- **Answer:** For me, the best way to do this is by breaking down the task at hand into smaller tasks. I then prioritize these tasks in a project management tool like Jira. I also use a Kanban board to visualize the tasks that I am working on. For each task, I estimate the time it will take to complete it, and I thereby also estimate the time it will take to complete the entire project. I also plan in time for unexpected tasks that might come up. Once I have planned, I schedule focus-time on my calendar to work on the tasks.

- **Question 8:** Can you share an experience where you demonstrated leadership skills or took initiative?

- **Answer:** At my current position, we have recently hired a new engineer. The week that he started working with us, my team-lead was swamped with work, and this was causing the new-hire to sit idle for his first couple of days. The new-hire needed someone to help him get up to speed and guide him through some tasks. At this point, I took the initiative to mentor the new engineer. I had a set of tasks that I was working on, and I delegated some of these tasks to the new engineer. I also helped him get set up with the tools and software that we use. When I took on this initiative, I replaced the time I had allocated for the tasks I delegated with time for mentoring the new engineer, so that I could help him in an organized and effective manner. I also made sure to check in with him regularly to see if he needed any help. When he did need help, I would pair-program with him to help him get unstuck. I showed him many debugging techniques, and I also showed him how to perform professional code reviews. This made his first few weeks at our company very productive, and as a result, my team lead was impressed with both of our work. This way, not only did I finish my tasks in the time I had already allocated, but I also brought up a new engineer to speed, while creating a rapport with him.

- **Question 9:** How do you handle feedback and criticism from others?

- **Answer:** The way I handle feedback and criticism from others is by seeking it deliberately and regularly. This way, I mentally prepare myself to receive the feedback, and even something harsh is not unexpected. To do this, I also attempt to keep the demeanor positive by simply asking, “How can I improve?” after working with someone on a project.

In general, I am always looking for ways to improve, so I attempt to keep an open mind when receiving feedback. When someone provides me with suggestions on how to improve, I take their perspective with empathy, and I try to understand why they are suggesting the change. I also try to understand the context of the feedback, and I try to understand the problem that the feedback is trying to solve. I then take the feedback and incorporate it into my work.

- **Question 10:** What interests you about this position and our organization?

- **Answer:** It has been my dream to work in the field of autonomous machines, and I am very excited about the prospect of working at Tuff Torq. In particular, I am interested in the work that Tuff Torq is doing with off-road autonomous systems. I think this is a unique and exciting opportunity to build something that will have a positive impact on the world (usually, autonomous vehicles automatically means cars, but in this case, it is off-road and unique). I am also interested in the fact that Tuff Torq is a well-established company with a long history of innovation and excellence. I am excited to be a part of this tradition, and I look forward to contributing to the company's success.

- **Question 11:** How do you adapt to change and handle ambiguity?

- **Answer:** Change is the only constant in life, and I have plenty of experience adapting to change. Let me provide a concrete example. All the companies I have worked for have been usually acquired by larger companies, and this has often resulted in a change in the company culture. Sometimes, there has been ambiguity in the work that needs to be done as well. However, I have found that keeping a positive attitude is key in these situations. Wearing a smile and having a good sense of humor can uplift the morale of the team. I have also found that being flexible and accommodating to the new situation is important. For example, if a new process is introduced, I try to understand the reason for the process, and I try to follow it to the best of my ability.

When there is doubt in what needs to be done, I have found that taking initiative helping the company in any way I can is a good way to get started. For example, if there is ambiguity on how we need to organize the timeline of a project, it is best to take an initiative and schedule a meeting to discuss the timeline (as long as it is fine with my manager).

- **Question 12:** Describe a situation where you had to resolve a conflict with a colleague or team member.

- **Answer:** The recommended maintenance schedule for a Tuff Torq hydrostatic transmission varies depending on the product and the operating conditions. However, regular maintenance is essential to ensure the longevity and reliability of the transmission.
- **Question 13:** What types of fluids are recommended for use in a Tuff Torq hydrostatic transmission?
  - **Answer:** Tuff Torq recommends the use of high-quality hydraulic fluids that meet the specifications outlined in the product manual.
- **Question 14:** What is the process for replacing a Tuff Torq hydrostatic transmission?
  - **Answer:** The process for replacing a Tuff Torq hydrostatic transmission varies depending on the product and the equipment in which it is installed. However, it is generally recommended that the replacement be performed by a qualified technician.
- **Question 15:** What is the process for repairing a Tuff Torq hydrostatic transmission?
  - **Answer:** The process for repairing a Tuff Torq hydrostatic transmission varies depending on the type and extent of the damage. However, it is generally recommended that the repair be performed by a qualified technician.
- **Question 16:** What is the process for troubleshooting a Tuff Torq hydrostatic transmission?
  - **Answer:** The process for troubleshooting a Tuff Torq hydrostatic transmission varies depending on the type of problem and the equipment in which it is installed. However, Tuff Torq provides detailed troubleshooting guides and technical support to help customers diagnose and resolve issues with their products.
- **Question 17:** What is the process for ordering replacement parts for a Tuff Torq hydrostatic transmission?
  - **Answer:** Replacement parts for Tuff Torq hydrostatic transmissions can be ordered through authorized dealers and distributors, or directly from Tuff Torq.
- **Question 18:** What is the process for upgrading a Tuff Torq hydrostatic transmission?
  - **Answer:** The process for upgrading a Tuff Torq hydrostatic transmission varies depending on the product and the type of upgrade. However, Tuff Torq provides detailed information and technical support to help customers upgrade their products.

- **Question 19:** What is the process for disposing of a Tuff Torq hydrostatic transmission?
  - **Answer:** The process for disposing of a Tuff Torq hydrostatic transmission varies depending on the type of equipment and the local regulations. However, it is generally recommended that the transmission be disposed of in an environmentally responsible manner.
- **Question 20:** What is the future of Tuff Torq?
  - **Answer:** Tuff Torq is committed to continuing its tradition of innovation and excellence in the field of hydrostatic transmissions. The company is constantly developing new products and technologies to meet the evolving needs of its customers.