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1. General Guidelines
   1. General Expectations

We consider this to be a “full stack” developer test to help us get to know you, your skillsets, and your experience level as well as possible. We hire team members ranging from entry-level to seasoned developers across various areas of the stack, so our goal with this process is simply to determine if we’re a good fit to work together.

You may be comfortable answering all of the questions and if so that’s great! If you feel like some are just not “your thing” that’s fine too. Not every role on our team needs to know *everything* on this test, so just do your best and focus on showing us who *you* are!

* 1. Timebox

This test is intended to be something you can complete in approximately 4 hours depending on skill level. Everyone works at a different pace, so it’s completely acceptable if you want to spend more time, but please don’t spend all day on it.

* 1. Timeline

Generally, we expect to receive your completed response for this test within a week of us sending it to you. If you feel you need more time or something comes up, please let us know.

Once our team receives your completed test, we will generally review and respond within two weeks. At that point, we will either schedule an interview (via phone or in-person) or let you know that we have determined we aren’t the best fit for each other.

* 1. Sending Your Completed Response

For essay questions, please type your written response in the space provided. Each question has at least a half-page allotted for consistency. This simplifies formatting but is not an expectation of how much space each individual question should or shouldn’t take, please take as much or little space as you need.

For the questions that require code as part of the response, please send your completed code as a separate code file and not embedded in the Word document. Hosting on a public GitHub repo is also acceptable. Please be sure to note either the filename or the URL in your written answer to the question.

If you are sending completed code through email and not via a URL for a public repository, please:

1. **Do not attach zip files** as they are blocked by our email filters.
2. **Append “.txt” to the filename** of each code file before attaching to the email. (E.g., “validation.js” becomes “validation.js.txt” so it isn’t filtered by our email rules.)
3. **List the filenames of all attachments** so we can verify nothing was blocked by our email filters.

Name your completed Word document in the format of:

**MetroNet Developer Test - Your Name (YYYY-mm-dd)**

Name any file attachments (for code samples) in the format of:

**MetroNet Developer Test - Your Name (YYYY-mm-dd) - Question Name**

(If a question requires multiple files, please name them accordingly.)

Unless otherwise specified, you may simply reply to the email in which we sent you the test and attach the file containing your completed response.

* 1. Language/Environment

We believe that good developers can learn multiple programming languages, so our goal is to test your general ability to code and reason through problems, not quiz you on a specific syntax or library. Unless otherwise specified, feel free to use whatever programming language you feel most comfortable with to complete this test.

* 1. Online Resources

We believe that searching for answers in Google, Stack Overflow, etc. is part of a developer’s daily workflow and knowing where to find an answer is often as important if not more important than knowing it.

If you use any online resources to help you complete an answer please indicate which ones and a short description of your thought process, including any information you feel relevant such as search terms, what syntax you wanted to verify, etc.

We reserve the right to verify your answers with online tools to check for plagiarism, so be sure not to just copy/paste something from Wikipedia.

* 1. Asking For Help

We believe that helping other team members and being willing to ask questions is an important part of a being a developer. If you get stuck or something doesn’t make sense, please reach out! Just email your hiring contact explaining what’s up and we’ll do our best to accommodate.

1. Requests & Debugging
2. 1. Debugging: Page Doesn’t Load

You’ve developed a **(known working)** web application that, when accessed, will dynamically retrieve a set of data from an SQL database and display it as HTML. When you visit the URL of the application, the page is blank. Describe your troubleshooting steps.

1. Make sure there is active Internet connection.
2. Make sure you are trying to reach to correct URL.
3. Try opening the URL/web application on different browsers if your web site supports only specific browser.
4. Check the settings and browser compatibility if it is blocking the web application to load.
5. Try clearing out the cookies and cache.
6. Check if the previous release of web application is working and if so, there is some glitch with new version. Debug and troubleshoot the code for newly added features and compatibility with existing features/code.
7. Make sure the SQL server is Up and running. There are no infrastructure changes happened recently(updates, OS, patches).
8. Connect with the server and check for ‘tcpdump’, if there is packet loss happening and your request is not reaching to the server.
9. Development
10. 1. Data Types

Describe the differences, similarities, and common development pitfalls between, null, an empty string, the number 0, a string containing only the number 0, and Boolean false.

1. Null: null data type means that variable does not exist.
2. An empty string: string variable is declared but value is not initialized in there (the string variable exists but there is no data in there or data has not been stored there. i.e.- str =””)
3. The number 0: value zero is initialized to a variable (i.e.- x=0)
4. A string containing only the number zero (0): string is initialized with number 0 which is of type string (not int). string is not empty. (i.e. - str = “0”)
5. Boolean false: when condition does not meet for the identity or comparison operation, result will be Boolean false.

Difference:

1. In strongly typed languages, such as .Net, Null and Empty string are different entities. Whereas, in weakly typed languages, such as PHP, null and empty string are similar entities.
2. In JavaScript all these values are ‘falsely’ values (https://codeburst.io/javascript-double-equals-vs-triple-equals-61d4ce5a121a). False, 0 and “” equates to same value.
   1. Code Quality

How would you describe "good code"? What role (if any) do comments, refactoring, and code reviews play?

1. The code, which is free of bugs, follows coding standards SOLID Design principles, has minimal space and time complexity would be a good code.
2. Code containing appropriate function and variable name help to understand code in better sense. comments improve the readability and helps other developers to understand the flow of code and functionalities.

Comments:

1. Comments in code plays an important role. It helps other developers to understand the code, its functionality, flow of the code and working.
2. It helps another developer to understand the functionality of feature, what to provide as input and what to expect as output from the code/function.
3. It helps to speed up the process of understanding others code and development.
4. It helps to track the code changes as per requirements.

Refactoring:

1. Refactoring helps to restructure the existing code by modifying its internal structure without changing the functionality.
2. It helps to minimize the dependency of functions on each other by creating individual functions to perform individual task.
3. It optimizes the code, makes it reusable and independent of other functions.
4. It reduces the enhancement cost and new features can be added easily.

Code Reviews:

1. Code review helps to find the bugs in the software before releasing it to the production and improving the code quality.
2. It helps in optimizing the code by reviewing it with peer and Senior developers.
3. It helps to verify all the requirements are implemented correctly.
4. Code reviews improves the speed of development and less defect gets reported after releasing the software in production. Which help developers to focus on new development / enhancements and less worry about fixing the defects.
5. It improves customer satisfaction as well.
   1. Code Structure

What criteria do you have for deciding when a single method/function does "too much" and needs to be broken down into multiple methods/functions?

1. Check for the sub-functions which can be separate out from main function and called as needed(refactoring).
2. It will improve the code reuse and readability.
3. Use Single Responsibility Principle to implement methods/functions.
4. Find the common code which is used at multiple places and convert it in reusable function.
5. Check the length of code and identify the code which can be used as a function to perform a task.
6. Check for the existing libraries/functions, which can be imported in code to perform required task. It will minimize the code length.
7. Past Projects
   1. Completed Project

Describe the project you have worked on that you are most proud of. What was your part in the project that worked out particularly well?

* During my tenure at KPIT, I was working on Cummins projects. I was involved in various projects and tasks. Discuss new Tool Interface Specification requirements with stakeholders, designing and implement those. Working on enhancing C# and Python applications to automate the tasks and minimize the manual efforts. Perform Engineering Standard Work for software before releasing the software in production.
* Another team was working on implementing the Embedded C software for Datalink Communication messages. They had less bandwidth and were looking for helping hands to implement new features. During our team meeting I got to know about their requirement. I pitched in to work on the task. This task was new for me. I prepared myself by learning the algorithms used in development of Datalink Communication messages. Attended code reviews for teammates / peers’ reviews to understand the requirements and structure of the development process.
* I was responsible for finalizing the requirements with stakeholder and architect, documenting those in PTC Integrity Tool. Gathering the required literature and database files. Understanding the structure of messages and implementing the software accordingly. Review the code with peer and architect. Work on improving the code as per review comments. Create Prototype build for the software and test the functionality by downloading the software in simulated environment(ECM-Bench setup). Verify that existing functionality and newly added features are compatible and working as per expectation using CANalyzer, Calterm, Peak and other Tools. Verify the CAN messages are being transferred and received on requested ports appropriately. Upon final review and approval check-in the code in Version Control System for tracking and provide the software for further integration and system testing.
* In this project I learned new technologies, tools, coding standards and implemented the software. It was new assignment for me, and I was eager to explore new skills used in this project. I learned the skills required for the task and implemented the project in specified duration. It was a great learning experience for me as well as a big help for the project team. Team was able to release the product in predefined timeline.

5. Additional Comments

1. 1. Is there anything else you think we should know, or you’d like to share?

I hold a Masters in Electronics and later post graduate Diploma in Advance Computing, Pune ACTS from India. After coming to USA, prepared myself for GRE, TOEFL and got admitted to Purdue University ( IUPUI Campus) for Master’s in Electrical and Computer Engineering (Specialization: Computer Engineering) and passed out in December 2015 with GPA 3.43/4.

After completing my masters, I joined KPIT in 2016 and worked for Cummins until Sep 2020. Due to some visa glitch I had to resigned in September last year. But I recently received my EAD and actively looking for new opportunity.

During this break, I made sure, I continuously challenge myself by keeping up to date with the skills I possesses and enhance those to keep aligned with the changing job markets. I have completed several online courses like Python, C#, C++, JavaScript’s, AWS, Cloud computing, Linux etc., Recently, I got selected at Udacity for their Cloud Native Suse challenge course and been working on it.

I have good understanding of algorithms, data structures and complexity analysis.

So, learning never stopped for me and understanding and picking up new work wouldn’t take time.

6. Coding Samples

1. 1. Custom Sorting

**Task:** Write a function to sort a hand of cards.

**Input Parameters:** a list/vector/array of Card objects

**Return Parameter:** a list/vector/array of Card objects that are sorted

**Assumptions you don’t have to code:**

* Each card object has an attribute called **suit** that returns the suit of the card as a string: “Hearts”, “Spades”, “Clubs”, “Diamonds”
* Each card object has an attribute called **value** that returns a character representing their value: 2, 3, 4, 5, 6, 7, 8, 9, J, Q, K, A

**Requirements:**

* The cards should be sorted in **ascending** order unless you implement the bonus flag below. In that case, the default should be ascending unless overridden by the flag.
* **Bonus:** Add a flag to say whether to sort in ascending or descending order.

**Domain Knowledge:**

* Playing cards are ordered by **value** then by **suit**.
* For values, assume: 2 < 3 < 4 < 5 < 6 < 7 < 8 < 9 < J < Q < K < A
* For suits, assume: Hearts < Diamonds < Clubs < Spades

**Example of Sorted Cards:**

1. 3 of Clubs
2. 7 of Hearts
3. Ace of Hearts
4. Ace of Spades

**Context/Hints:**

* Try to treat this like you would any other real-world sorting problem you may encounter in normal business logic.
* Feel free to write additional helper functions or other functions associated with the Card object to help accomplish the task.

**Code File:** MetroNet Developer Test - Pallavi Agarkar (2021-06-18) - 8.1\_newSortHandOfCards.py.txt



* 1. Data Validation

**Task:** Write a simple script to validate a set of contact records and report on any errors.

**Given:**

* A list of 20 contact objects (full names, city, phone number, and email address)

**Step 1: List all contact records with the following output:**

* Full name
* Whether the phone and email fields are "valid":
  + Output "Valid" if both email and phone are valid.
  + Output "Email is invalid." if email is invalid and phone is valid.
  + Output "Phone is invalid." if phone is invalid and email is valid.
  + Output "Email and Phone are invalid." if both phone and email are invalid.

**Step 2: List each city and report the following output:**

* Name of city
* Number of validation errors

**Requirements:**

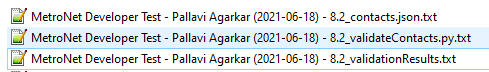
* Contacts should be sorted alphabetically in **ascending** order.
* Cities should be sorted by number of validation errors in **descending** order.

**Validation criteria:**

* Email field: has exactly one @ symbol with data on each side
* Phone field: is numeric with only digits, dashes, and spaces allowed

**Data Set:** Use the records in Contacts.json, which are based off of U.S. census data via Wikipedia’s list of [given names](https://en.wikipedia.org/wiki/List_of_most_popular_given_names) and [surnames](https://en.wikipedia.org/wiki/List_of_most_common_surnames_in_North_America).

**Code file:**



* 1. Simple Web Form

**Requirements:**

* Page title should be “Team Introduction”.
* Page should have a simple HTML form that requests two fields of input: your name and a fun fact about yourself.
* The form should have a button to introduce yourself.
* When the submit button is clicked, both input fields should be validated, and an alert message shown if there is an error.
* If there are no errors when the form is submitted:
  1. The validated data should be logged to the browser’s developer console.
  2. The form should be hidden and replaced with a new box displaying the input (name and fun fact).
* The “introduction box” should have a link or button to reset the form and allow “introducing” a different team member.
* **Bonus:** Use SCSS or describe how you’d refactor your CSS if SCSS was available in the build environment.

**Code file:**

