CIRADA UAlberta Technical Assessment

April 2019

This document describes the technical assessment process for the two CIRADA positions at the University of Alberta, S107838284 Software Developer: Visualization and Database Development (hereafter VisDB_Dev) and S107838285 Software Developer: Transient Software Developer (hereafter Transient_Dev). Each position has a separate, but related technical assessment. If you have applied for both, please be prepared to address both assessments.

The purpose of this exercise is to evaluate your abilities at working with some astronomical data and also to determine how effective you are at using outside resources to learn about a problem. You should use whatever resources you think are appropriate for responding to this assessment. We are most interested in your approach to solving these problems, so be prepared to discuss the process you went through in exploring these assessments.

A copy of this document, as well as any data files are provided at https://drive.google.com/drive/folders/1KuuePXb6Ds4__FQr2-EI1JUyUSlBjl74?usp=sharing.

For this assessment, we suggest that applicants consider the Astropy Project, “a community effort to develop a common core package for Astronomy in Python and foster an ecosystem of interoperable astronomy packages,” at http://www.astropy.org.

Deliverables: We ask that you submit your code via email for review 24 hours before your interview time. You may develop solutions in whatever language you deem appropriate. You should also be prepared to make a 10-15 minute presentation of your solution(s).

Data Explanation

For this technical assessment, applicants will be dealing with catalog data from a past radio astronomy survey called FIRST. The data are stored in FIRST_data.fit, which is a FITS (Flexible Image Transport System, a standard format in astronomy) binary table file. There is a brief file that describes the columns in the FITS binary table, FIRST_data_columns.txt, which is a CSV text file.

FIRST_data.fit use formate one

One of the ways that astronomers quantify the position of a source on the sky is with the equatorial coordinate system, where Right Ascension (RA) is often plotted akin to an x-axis (a longitude) and Declination (Dec) is often plotted akin to a y-axis (a latitude). Astronomers often use two formats for these axis, decimal degrees and a sexigessimal format. In the former, Right Ascension goes from 0.0 to 360.0 degrees and Declination goes from -90.0 to +90.0 degrees. In the latter Right Ascension goes from 00:00:00 to 24:00:00 (hours, minutes, seconds) and declination goes from -90:00:00 to 90:00:00 (degrees, arcminutes, arcseconds). ('J000650.8+005845', 1.711683333333333, 0.979411111111111, 1.37, 'g')
('J134452.3+005842', 206.21805833333332, 0.9785972222222221, 0.58, 's')

One of the ways that radio astronomers quantify the brightness of a radio source in the sky is with the Integrated Flux Density where the standard base unit is Janskys, abbreviated as Jy.

As “Fint” in data

VisDB_Dev Assessment

Create a tool that displays the positions of FIRST sources on the sky (i.e., their coordinates) within a 0.25 degree (0.25 degree = 15 arcmin) radius of a user-specified position. The visualization should also convey the relative flux densities and SDSS classification of these FIRST sources. Your implementation should allow a user to specify a position in decimal coordinates (RA, Dec). Be prepared to present the results for RA = 338.12, Dec = 11.53. You have the option of considering several extensions:

- Describe what would need to be done to allow the user to specify the radius for matching sources.
- Describe what would need to be done to allow the user to specify a FIRST source around which to do the same query.
- Describe what would need to be done to allow the user to specify a position in sexigessimal coordinates.

Your code should write out a PNG file embedded in HTML that can be viewed in a browser.

Transient_Dev Assessment Data embedded in HTML

Create a tool that returns a table of all FIRST sources within a 1 degree radius of a user-specified position, summarizing their positions, angular separation from the user-specified position, integrated flux density and SDSS classification. Sort the returned information based on the angular separation of sources from the user-specified position. Your implementation should allow a user to specify a position in decimal coordinates (RA, Dec). Be prepared to present the results for RA = 338.12, Dec = 11.53. You have the option of considering several extensions:

- Describe what would need to be done to allow the user to specify the radius for matching sources.
- Describe what would need to be done to allow the user to specify a FIRST source around which to do the same query.
- Describe what would need to be done to allow the user to specify a position in sexigessimal coordinates.

Your code should write out a table embedded in an HTML file that can be viewed in a browser.