

Bochum AG Tagung 2016 GAVO Puzzler: Hints

Hint 1

Use a TAP service and ADQL. In ADQL, you'd write spherical triangles as POLYGON(coordsys, ra1, dec1, ra2, dec2, ra3, dec3)

Hint 2

Even in these days, for bright stars there's few better catalogs than Dorrit Hoffleit's Bright Star Catalog (VizieR table Id: v/50; but it's also available elsewhere).

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The first step is to obtain a machine-readable representation of the area of interest. Whatever we do, we first need the coordinates. We could get them from Simbad's web interface, but of course it's much more flexible to pull them via TAP (you can easily teach a computer to do that, for instance).

So, in TOPCAT, select VO/TAP from the menu, search for Simbad, "Use Service", and run the query.

```
SELECT ra, dec FROM basic WHERE main_id IN (
  '* alf Cyg', '* alf Aql', '* alf Lyr')
```

For this example, you can manually, cut and paste from the result to obtain the ADQL polygon specification:

```
POLYGON('ICRS',
  279.2347347870248, 38.78368895624398,
  310.35797975307673, 45.280338806527574,
  297.69582729638694, 8.868321196436963)
```

To figure out how many stars are in there, you need to match against a halfway complete list of bright stars, which is non-trivial.

Simbad itself, for instance, doesn't reliably have V-band fluxes, and getting the fluxes in the first place is a bit tricky. Here's a proposal for how to get started:

```
SELECT
  COUNT(*)
FROM basic JOIN flux ON (flux.oidref=basic.oid)
WHERE
  flux<5
  AND filter='V'
  AND otype='*'
  AND flux!=0
  AND 1=CONTAINS(
    POINT('ICRS', ra, dec),
    POLYGON('ICRS',
      279.2347347870248, 38.78368895624398,
      310.35797975307673, 45.280338806527574,
      297.69582729638694, 8.868321196436963))
```

– this yields 11, which is *not* the answer we are looking for (but Simbad masters could probably make it do the right thing). The great thing about the VO is that it's so easy to switch from one resource or service to the next.

The classical star catalog for a purpose like this would be the Bright Star Catalog, which you can find on Heasarc's and VizieR's (currently with a bit more effort; it's v/50) TAP services. Try looking either for "bright star catalog" or "hoffleit" in TOPCAT's TAP dialog.

Here's the query for the Heasarc service:

```
SELECT COUNT(*) FROM bsc5p
WHERE
  vmag<5
  AND 1=CONTAINS(
```

```
POINT('ICRS', ra, dec),
POLYGON('ICRS',
  279.2347347870248, 38.78368895624398,
  310.35797975307673, 45.280338806527574,
  297.69582729638694, 8.868321196436963))
```

(to query on VizieR, replace bsc5p with "V/50/catalog" and ra and dec with raj2000 and dej2000, respectively). In each case, the answer is 28, so that's the canonical value.

For comparison, you can try Tycho 2. There's a copy of it on ARI's Gaia service (and TOPCAT will find it for you). Query it using

```
select count(*) from tycho2
where
  vtmag<5
and 1=contains(
  point('ICRS', ra, dec),
  POLYGON('ICRS',
    279.2347347870248, 38.78368895624398,
    310.35797975307673, 45.280338806527574,
    297.69582729638694, 8.868321196436963))
```

That's 26, which would be a fair answer, too (we didn't do a proper analysis of the errors involved anyway).

Just because we can, let's see how things are in the near infrared (2MASS, here in the version you get on the GAVO TAP service):

```
select count(*) from twomass.data
where
  jmag<5
and 1=contains(
  point('ICRS', raj2000, dej2000),
  POLYGON('ICRS',
    279.2347347870248, 38.78368895624398,
    310.35797975307673, 45.280338806527574,
    297.69582729638694, 8.868321196436963))
```

If you're curious what this gives, you'll have to run this yourself...