Quasars Project Solutions

Question 1. The first object appears as an unremarkable star in the visual image. In the radio image, it has a nice central point with two jets emanating from it. The second object is listed as a galaxy, but there is no discernable structure to it in the visible picture. The radio image reveals two bright sources, although they are widely separated and may not be related. The third object is a plain blue-white star in the visible picture, but a double lobe radio source when you look at the FIRST image. The last image is a dim red star in the SDSS data, but FIRST shows a large radio source with a small second lobe beneath it.

Question 2. Photo classified the objects as a star, a galaxy, a star and a star, in that order.

Question 3. The star spectrum has typical hydrogen and calcium absorption lines. It is a fairly good thermal source. The galaxy spectrum has a much wider variety of lines including hydrogen, calcium, oxygen, sodium and nitrogen. It is obviously a non-thermal source. The quasar spectrum is dominated by a few emission lines from magnesium and hydrogen.

Exercise 2.

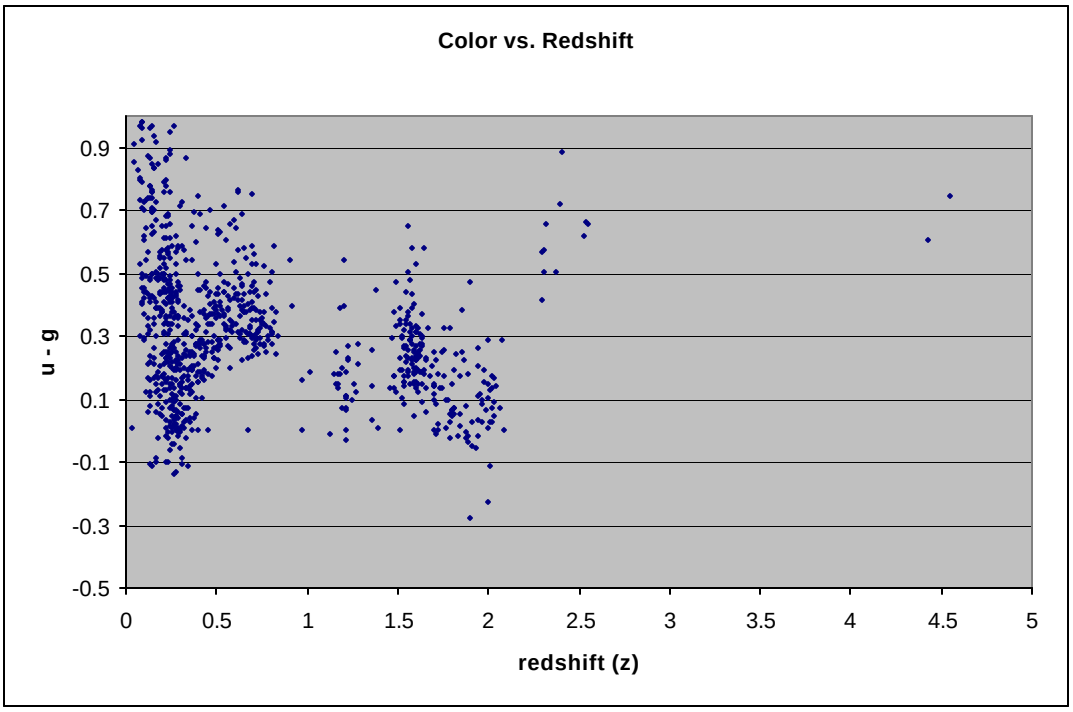
Plate	Fiber	Redshift	Emission Lines
358	504	.0472	Strong hydrogen alpha, beta, gamma, and delta lines; strong OII and OIII lines
350	73	.5598	Weak hydrogen beta, gamma, and delta lines; weak OII and OIII lines; strong magnesium line
390	537	1.2448	Weak OII lines; strong OIII and magnesium lines
309	556	2.5526	Weak CIII, strong CIV, strong NV, very strong Lyman alpha
385	492	3.9568	CIV, SiV, OIV, NV, strong Lyman alpha, OVI
286	183	5.1093	Strong Lyman alpha and OVI

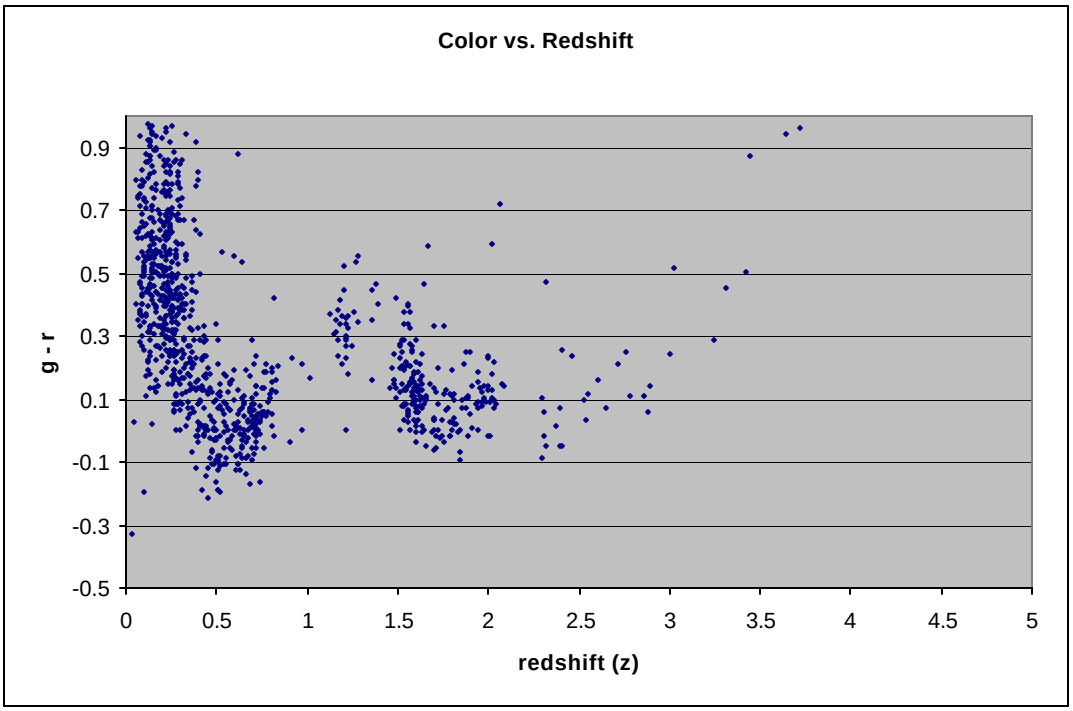
The lines march steadily to the right as redshift increases. As some lines disappear off the right side, new lines appear on the left. The Lyman alpha line actually starts way off in the ultraviolet and is redshifted to the visible part of the spectrum!

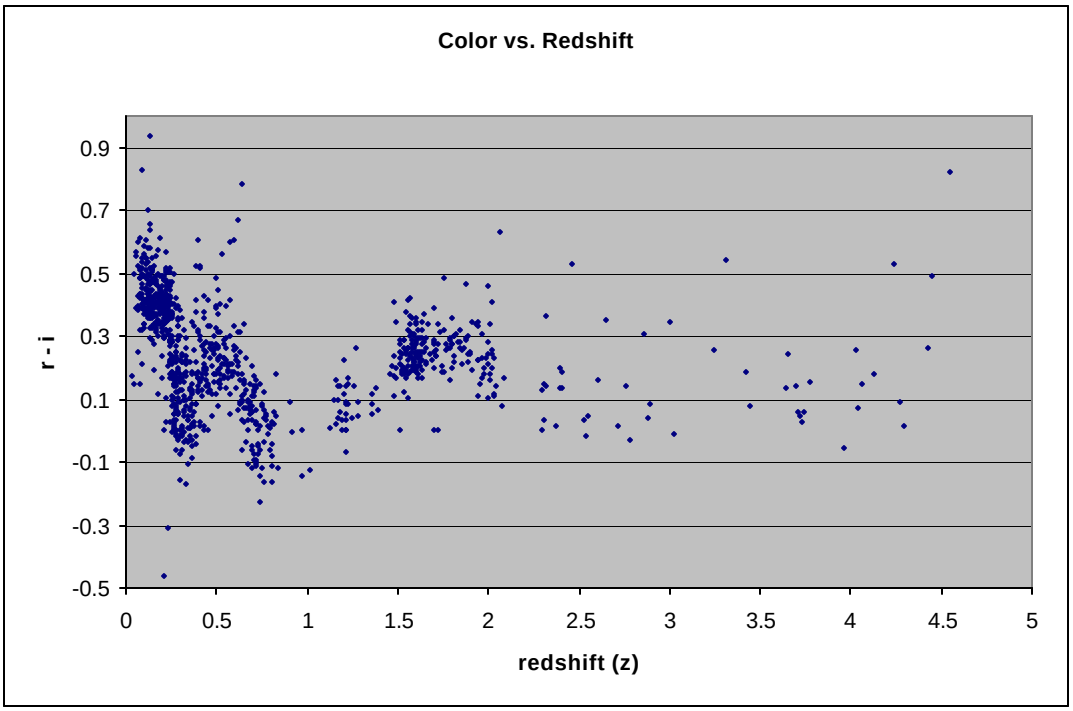
Exercise 3. You should get a table of 1,000 quasars. Here are the first five quasars that the query returns, copied directly from the query tool results:

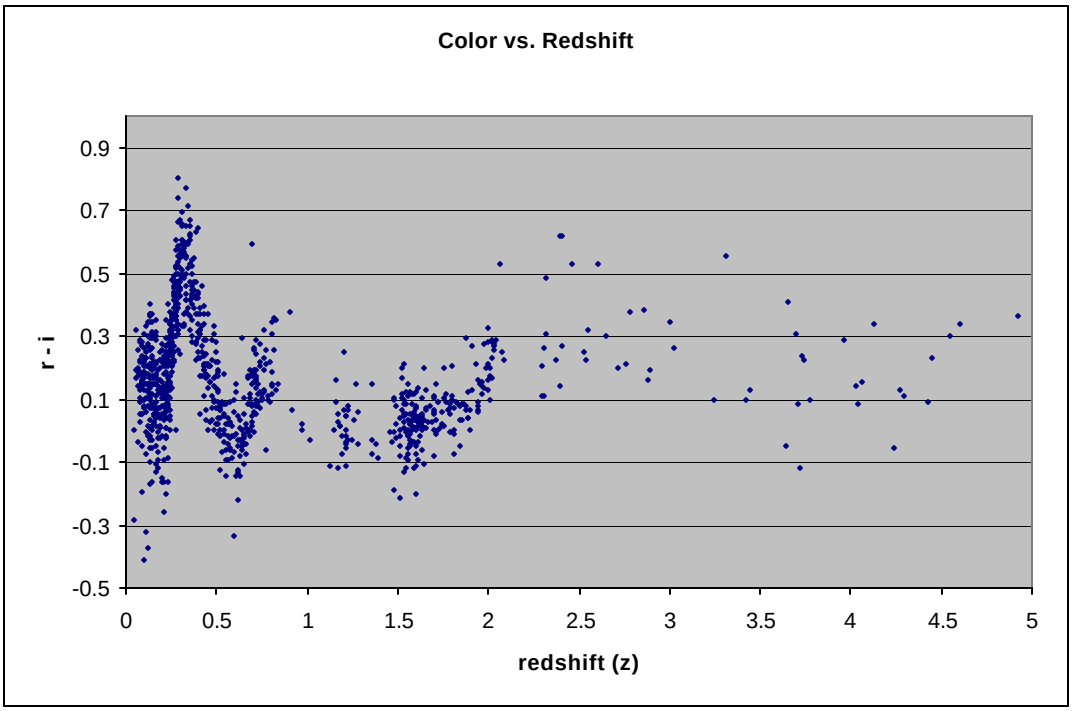
plate	mjd	fiberID	redshift	u	g	r	i	z	ra	dec	ObjID
266	51630	252	0.34	18.903	18.549	18.28	18.249	17.861	145.465214	-1.064442	2255029898379431
266	51630	200	0.289	18.503	18.52	18.149	17.953	17.42	145.925291	0.048807	2255030703882409
267	51608	313	0.423	18.541	18.319	18.187	18.107	18.023	147.430567	0.093378	2255030704537755
267	51608	349	1.49	18.59	18.417	18.113	17.874	17.979	147.140611	0.416237	2255030972842129
266	51630	351	1.479	19.066	18.933	18.771	18.595	18.597	145.338657	0.140355	2255030703620285

Exercise 4. Sample diagrams are shown below. The diagrams graph redshift against (in order) u-g, g-r, r-i and i-z colors.

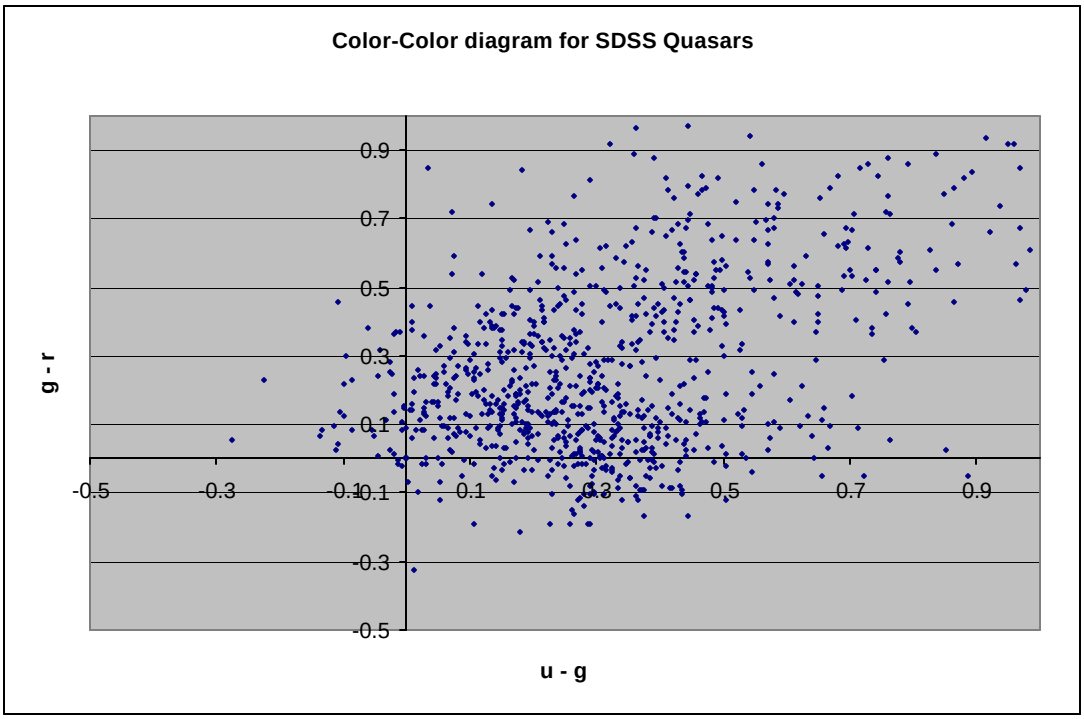


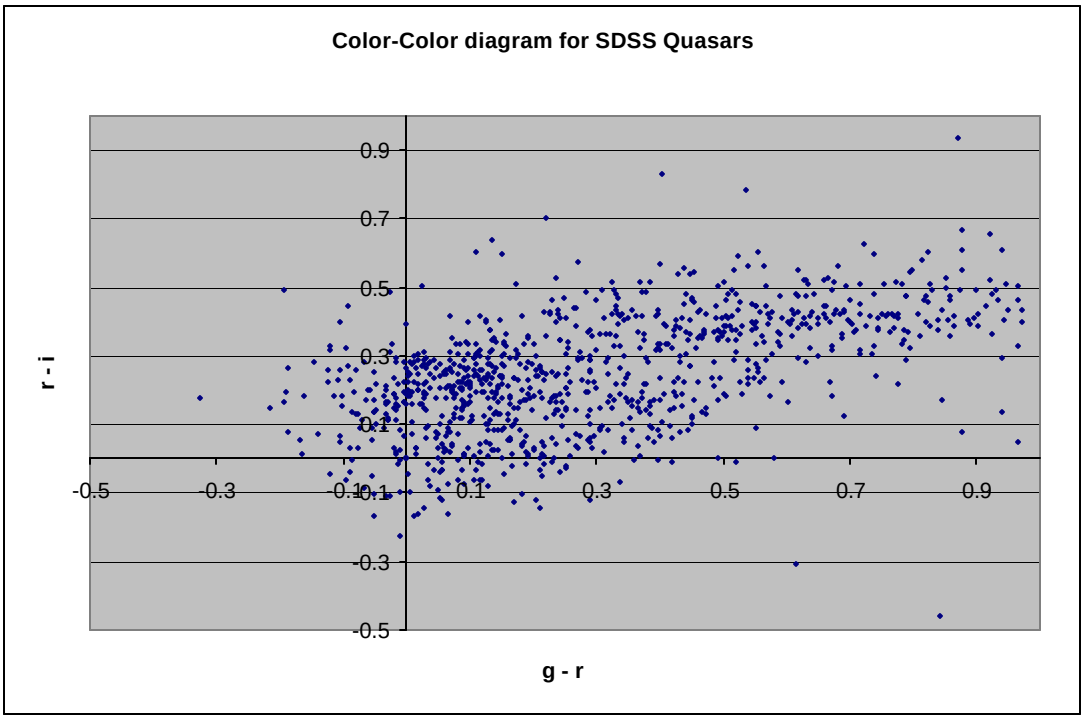

Color vs. Redshift
g - r
0.9
0.7
0.5
0.3
0.1
-0.1
-0.3
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
redshift (z)

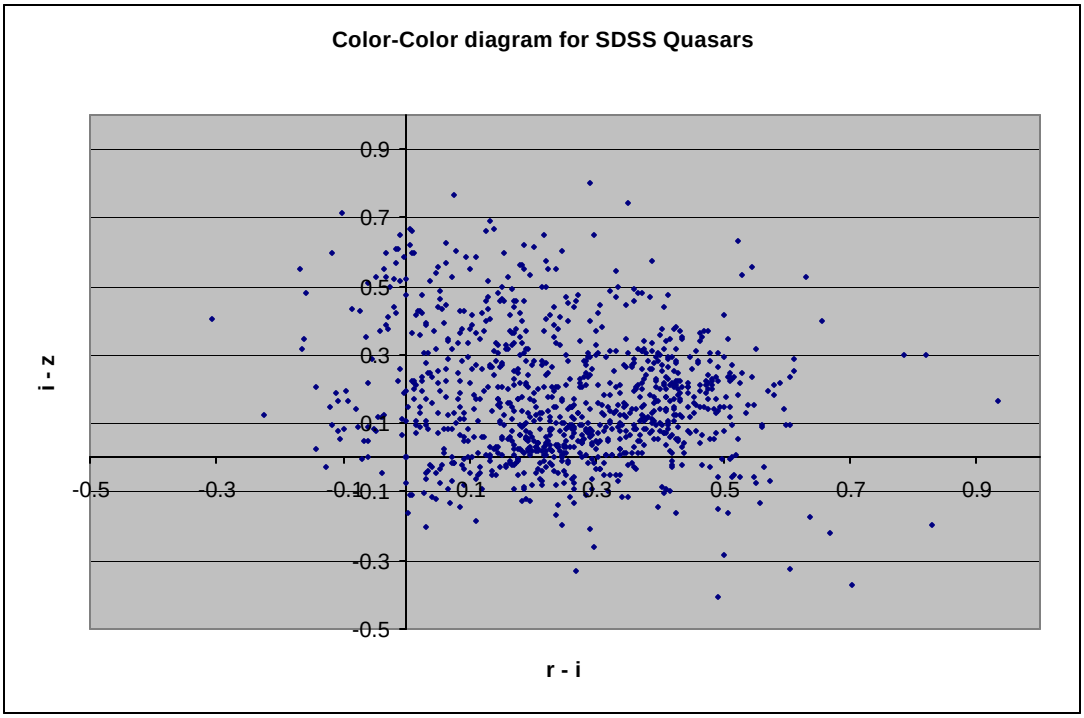

Color vs. Redshift
r - i
0.9
0.7
0.5
0.3
0.1
-0.1
-0.3
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
redshift (z)



Exercise 4. Here are some sample color-color diagrams for the data. The diagrams show, in order, u-g vs. g-r, g-r vs. r-i, and r-i vs i-z.




Color-Color diagram for SDSS Quasars
0.9
0.7
0.5
0.3
0.1
-0.1
-0.3
-0.5
-0.5
-0.3
-0.1
0.1
0.3
0.5
0.7
0.9
r - i
g - r


Color-Color diagram for SDSS Quasars
0.9
0.7
0.5
0.3
0.1
-0.1
-0.3
-0.5
-0.5
-0.3
-0.1
0.1
0.3
0.5
0.7
0.9
i - z
r - i