AFNI Jazzercise Answers

NB: the code snippets below will likely **not** copy+paste well into your terminal. This is not just laziness on our part, but instead it is meant to be helpfully didactic by prompting you to type the commands yourself, thereby getting used to the AFNI program syntax. And while typing, *please do* make use of the auto-completion features from both the Linux terminal and AFNI itself (→ via the "apsearch -update_all_afni_help" command).

Below are the solutions to the AFNI Jazzercise questions.

1. ```
   3dbucket –prefix some_stats func_slim+orig'[0,3-$]'
   ```

2. ```
   3dMean –prefix anat_mean  anat+orig second_anat+orig
   ```

3. ```
   3dAutomask –apply_prefix epi_auto epi_r1+orig
   3dSkullStrip –input epi_r1+orig –prefix epi_3dSkull &
   ```

4. Creating and Playing with ROI Masks:
   a. ```
      3dcalc -a 'func_slim+orig[2]' -b 'func_slim+orig[4]' \
             -expr 'ispositive(a-4.2) * ispositive(b-4.2)' \
             -prefix VA_mask
         or
      3dcalc -a 'func_slim+orig[Vrel#0_Tstat]' -b 'func_slim+orig[Arel#0_Tstat]' \
             -expr 'ispositive(a-4.2) * ispositive(b-4.2)' \
             -prefix VA_mask
      ```

   b. ```
      3dcalc -a 'func_slim+orig[2]' -b 'func_slim+orig[4]'   \
             -expr 'ispositive(a-4.2) + 2 *ispositive(b-4.2)' \
             -prefix VA_mask_4
         or
      3dcalc -a 'func_slim+orig[Vrel#0_Tstat]' -b 'func_slim+orig[Arel#0_Tstat]' \
             -expr 'ispositive(a-4.2) + 2 *ispositive(b-4.2)' \
             -prefix VA_mask_4
      ```

   c. Use the "**Pos?**" toggle button (in the AFNI GUI→Define OverLay) for positive-only intensities, and set the "**#\*\***" (number of colors) to 4.  Red, orange and yellow are values 1, 2, and 3, respectively. Alternatively, use one of the ROI color scales (right click on the overlay color bar) for the overlay named (ROI_32) and use a corresponding maximum, i.e. 32 with positive only intensities.

   d. ```
      3dROIstats –mask VA_mask+orig –mask_f2short –quiet epi_r1+orig > VA_mean.1D
      ```

5. Understanding the regression matrix:
   a. There were 3 runs, as shown by the sets of polynomial baseline regressors.
   b. Baselines were modeled with cubic polynomials (degree 3). There were 4 baseline regressors per run, constant, linear, quadratic and cubic terms.
   c. There were 2 regressors of interest, coming after (above in graph) the polynomial baseline regressors and before (below) motion.
   d. This was a BLOCK design. Note that the idealized BOLD responses last for 16 or 17 TRs. In this case, one would want to set TR = 2.0 seconds.

e. One might recall that the runs were 150 TRs, but the polort terms show run 1 lasting perhaps only 146 TRs. Further investigation of the results shows that 4 TRs were censored from the first run (e.g. looking at **motion_FT_censor.1D**).

f. The significant motion during scanning was censored (run breaks do not count). Compare with a plot of **dfile.rall.1D** or perhaps **X.nocensor.xmat.1D**.

6. Fun with 1D files:

a.
```
count -column 1 10 > col1.1D
count -column 11 20 > col2.1D
count -column 21 30 > col3.1D
```

or

```
count 1 10  > row1.1D
count 11 20 > row2.1D
count 21 30 > row3.1D

1dtranspose row1.1D > col1.1D
1dtranspose row2.1D > col2.1D
1dtranspose row3.1D > col3.1D
```

b.
```
1dcat col1.1D col2.1D col3.1D > 3cols.1D
```

or

```
1dcat col?.1D > 3cols.1D
```

or

```
1dcat row1.1D\' row2.1D\' row3.1D\' > 3cols.1D
```

c.
```
1dcat col1.1D col2.1D col3.1D           \
      col3.1D col2.1D col1.1D  > 6cols.1D
```

or

```
1dcat 3cols.1D'[0..$,$..0]' > 6cols.1D
```

d.
```
1deval -a '6cols.1D[0]' -b '6cols.1D[1]     \
       -c '6cols.1D[2]' -d '6cols.1D[3]     \
       -e '6cols.1D[4]' -f '6cols.1D[5]     \
       -expr '(a+b+c+d+e+f)/6' > ex_mean.1D
```

or

```
3dTstat -mean -prefix ex_mean.1D 6cols.1D
```

7. Fun with the afni GUI:

a. Right-click the gray-scale bar of any viewing plane (e.g., sagittal) and select the **Choose Display Mode Range**. Type in the numbers **300 1200**.

b. Go to Define OverLay in the afni GUI. For both OLay and Thr select sub-brick #0 (Full F-stat). To display only positive overlay values, click on the "**Pos?**" button. To show only 8 panels in the color bar, select the "**#8**" button just below the color bar in the overlay panel. Now place your cursor on the color panel that is colored pink. If you leave your cursor there for a moment, the numbers 45-90 will appear. This means that F-values that fall within this range will appear in the Overlay dataset as pink. To change the color from pink to lime green, left-click on the pink panel and a hidden pop-up menu will appear that allows you to change the color.

c. The easiest way to save a jpeg file is to right-click on the **Sav1.ppm** button in the sagittal viewer. This will open a hidden menu that allows you to save the image as a ppm, jpg, gif, tif, etc. Select the **jpg** button. This will change the Sav1.ppm to a **Sav1.jpg** button. Click on that and type in the prefix name **cool_slide** and save it.

d. Right click in one of the viewing planes (e.g., sagittal), which will open a hidden menu. Select the **Go to Atlas Location** button and select the right cuneus from the menu.

e. Go to the sagittal viewer and click on the **Mont** (Montage) button at the bottom of the viewer. This will open the Montage controller. Select **3** slices Across, **2** slice Down and **Set**.

f. The Mission Statement is hidden in the empty space in the bottom left-hand corner of the afni GUI (just to the right of the **Done** button). Right-click in this empty space to gain access to the Mission Statement and other AFNI tidbits.

8. Doing calculations in AFNI:
   a. `3dinfo func_slim+orig`

      In the output, look for lines starting with '--At sub-brick'. The datum type is given following 'datum type is'.

   b. `ccalc '22.3 * 44.5'`

   c. `1deval -num 100 -dx 0.2 -expr 'sin(x)/(1+x)' | 1dplot -dx 0.2 -stdin`

9. Aligning data:
```
align_epi_anat.py -anat anat+orig -epi epi_r1+orig -epi_base 4 -suffix _jazzal \
  -AddEdge
cd AddEdge
afni -niml -yesplugouts &
@AddEdge
```

10. Image Filtering:
   a. `3dmerge -1blur_fwhm 8 -doall -prefix ex_blur8 epi_r1+orig`

   b. `3dLocalstat -nbhd 'RECT(0,0, -3)' -stat min \`
      `        -prefix ex_minz3 anat+orig`

   c. `3danisosmooth -viewer -prefix ex_anisotest ex_minz3+orig`

```
       3danisosmooth -prefix ex_aniso -iters 3 ex_minz3+orig
```

11. Random Exercises with AFNI Datasets:
```
   a. 3dinfo anat+orig     (and look for -orient)
      3daxialize -prefix exLPI -orient LPI anat+orig
      3dresample -prefix exLPI -orient lpi -inset anat+orig

   b. 3dbucket -prefix ex_arel_coef func_slim+orig'[3]'
      3dbucket -prefix ex_arel_tstat func_slim+orig'[4]'

   c. 3dbucket -prefix ex_arel \
               ex_arel_coef+orig ex_arel_tstat+orig

   d. adwarp -apar anat+tlrc -dpar func_slim+orig \
              -prefix func_slim4mm -dxyz 4

   e. 3dExtrema -volume func_slim4mm+tlrc'[0]' | head
      whereami -22 93 16 -rai

   f. 3dZcutup -keep 40 90 -prefix anat_40_90 anat+orig
```

12. Volume Rendering:
   a. Define Datamode, Plugins, Render [New]. Select Underlay to be anat+tlrc. Render with Draw. Rotate with the roll, pitch, yaw controls (preferably with DynaDraw turned on)
   b. If you do not already have the func_slim4mm+tlrc dataset created in 10d, select Overlay dataset to be func_slim+orig in main AFNI controller. In Define Datamode meu, choose Write Olay to disk to write out func_slim+tlrc dataset (or use adwarp or @auto_tlrc to do the same from the command line). In Render menu, choose Overlay, "Choose Overlay Dataset" and choose func_slim+tlrc. Set the overlay and threshold sub-bricks to Full F-stat as in the usual Overlay control panel adjusting the threshold to 10. Set "Show thru", and the "Show thru" percent to be about 70% and color opacity to 0.5.
   c. Right-click on the image viewer and select "Where am I?" Depending on whether you pick a voxel on the left or right you may find cuneus, fusiform gyrus or middle occipital gyrus. Right-click on the image viewer again and choose "Show Atlas colors" or create an ROI datasets with the Draw Dataset plugin and add an atlas region. Select the region you found with "Where am I?" and choose a color for it. In the Render plugin (and the overlay panel if you want to see it in the normal image viewer too), turn on "See TT atlas". Nudge the overlay threshold again and choose "Draw" again. If you turn on the "accumulate" function, you can get a video recording of changes you do in the rendering. Record as you "roll" and "pitch" the rendering and play back the video

13. Simple statistics:
```
   a. 3dinfo -verb rall_func+orig | less
   b. 3dinfo -verb rall_func+orig | less
   c.  cdf -t2p fitt 4.25 436
       fdrval -pval rall_func+orig 6 4.25
   d. cdf -p2t fitt 0.0001 436
      fdrval -pval rall_func+orig 6 3.92689
      cdf -p2t fitt 0.0002 436
      fdrval -pval rall_func+orig 6 3.75089
```