1. You generally did well on this problem. Let me know if you need more detail on how I got these solutions.

   (a)

$$\begin{aligned} y_t &= 20\sum_{i=0}^{t-1} .4^i + .4^t(100) \\ &= \frac{100}{3} + \frac{200}{3}(.4^t) \end{aligned}$$

   (b)

$$\begin{aligned} y_t &= .71^n(100) - 14.3\sum_{i=0}^{n-1} .71^i \\ &= (100 + 14.3/.29)(.71^n) + 14.3/.29 \end{aligned}$$

   (I rounded to 2 decimal places in the first expression.)

   (c) $y_t = 20t + 100$

   (d) $y_t = 100 + \sum_{i=1}^{t} \varepsilon_i$

   (e) $y_t = \sum_{i=0}^{\infty} \alpha^i \varepsilon_{t-i}$; if you assume the series starts at $y_0 = \varepsilon_0$ then the sum should only extend to t.

   (f) $y_t = y_0 + \sum_{i=0}^{t} \varepsilon_i$

2. Cobweb model. See accompanying spreadsheet for parameter values and plots. My second choice of parameter values caused p_t to explode because $|\frac{\beta}{\gamma}| > 1$. The model is called the cobweb model because a supply shock causes the economy to oscillate and either converge back to equilibrium or explode. The oscillations look like a cobweb when plotted on a demand and supply diagram.

3. The data were generated by the following models:

   - rebekah: $y_t = (1 - .7L)\varepsilon_t$. The spike in the ACF suggest an MA(1) model.
   - daniel: $(1 - .7L^3 + .25L^2 - .16L)y_t = \varepsilon_t$. The three spikes in the PACF and the gradual decay in the ACF suggest an AR(3).
   - zhuoxiansheng: $(1 - .3L^2 - .1L^2)y_t = (1 + 2L)\varepsilon_t$. That this is an ARMA(2,1) is difficult to see from the ACF and PACF.
   - sylvia: $(1 + .7L)y_t = \varepsilon_t$. The spike in lag 1 of the PACF and the oscillating decay of the ACF indicate an AR(1) with a negative coeff.
   - zhirui: $y_t = (1 + .7L)\varepsilon_t$. The spike at lag 1 of the ACF and the oscillating decay of the PACF indicate an MA(1) with a positive coeff.

- hao: $(1-.7L)y_t = \varepsilon_t$. "Textbook" AR(1) pattern of a spike at lag 1 of PACF and geometric decay in the ACF.
- joanne: $(1+.7L)y_t = (1+.7)\varepsilon_t$; this is how I generated the data, but note that the lag polynomials cancel out and this is just white noise.
- sebastian: $(1-.7L)y_t = (1+.7)\varepsilon_t$. ARMA(1,1) with a positive AR coeff., as indicated by oscillating decay in the PACF and geometric decay in the ACF.

4. I enjoyed looking at your plots for this problem. The point of this problem was to get you to play around with Stata's plot-making function, and for you to learn how to make labels and so on. Some of you did that, others didn't–but don't worry, you'll get more practice!

5. See my attached Stata log for the details. On your problem sets, I was unable to determine whether you had correctly annualized the data so take note of how I did this in my code. Also you may have used a different time frame than I did, so that could affect conclusions and could explain why you got different results than I did. Don't worry: I graded based on your analysis and not based on whether you results exactly matched mine.

   (a) When testing up to 10 lags, the AIC suggested 8 was the optimal number of lags. When only looking at the first five lags, the AIC and BIC both suggested 2 was the optimal number of lags.

   I tested the various lags manually, but also used the Stata command `varsoc` which automatically produces the AIC and other statistics for various levels of lags. The `varsoc` lag choice coincided with my lag choice (though the `varsoc` command produces a different form of the AIC).

   Also note that when comparing models according to the AIC or BIC, you should be sure the models are estimated with the same number of observations. (This is what the hint in the problem statement was about). For example, here there were 240 observations total. Each additional lag "uses up" one observation. So when I was comparing the five models with one through five lags, I ensured that each model was estimated using only 235 observations. `varsoc` does this automatically.

   (b) I failed to reject the hypothesis that there was a structural break.

   (c) Again, I found that 8 was the optimal number of lags (when restricting unemployment rate and inflation to the same number of lags).

   (d) The sum of the coefficients on the lagged values of unemployment reflects the cumulative effect of a one percentage point increase in the unemployment rate on inflation. For both time periods, I failed to reject the null hypothesis that the sum was 0.