1. (22 points) Explain the distinction between endogenous economic growth and exogenous economic growth. Briefly sketch a model of endogenous economic growth, and give a concrete example of a policy action by the government that affects the rate of economic growth in your chosen model.

2. (a) (22 points) Use the Barro-Gordon model of dynamic inconsistency in monetary policy to explain how a government’s inability to commit to a monetary-policy rule may land it in an equilibrium where expected inflation is high relative to the government’s preferred rate.

(b) (12 points; this question requires no math – just words, please.) In a world where bank runs are possible, such as the Diamond-Dybvig model’s world, the central bank of the economy can prevent bank runs by acting as a lender of last resort (LLR) to the private banking system. But if everyone knows the central bank will behave in this way, moral hazard will arise – lenders to the banks will not monitor its management, and the banks themselves will engage in excessively risky behaviors. In your opinion, is it dynamically consistent for the central bank to announce to the public that it will not step in as an LLR if banks get into trouble? Explain. What would the Nash equilibrium look like if the central bank exercises discretion, if people know it has LLR capabilities, and if no regulatory restrictions are placed on the behavior of private banks?
3. (22 points) Derive the $q$ model of investment, including the associated phase diagram. Then show how $q$ and $K$ adjust to (a) an unanticipated permanent rise in the real interest rate $r$ and (b) an anticipated future temporary rise in the real interest rate $r$.

4. (22 points) Suppose we have a quadratic utility function

$$u(c_t) = ac_t - \frac{b}{2}c_t^2$$

and that the consumer maximizes

$$E_0 \left\{ \sum_{t=0}^{\infty} \beta^t u(c_t) \right\}$$

where the real interest rate $r$ is constant and $\beta(1+r) = 1$. The intertemporal budget constraint is

$$\sum_{t=0}^{\infty} \frac{c_t}{(1+r)^t} = \sum_{t=0}^{\infty} \frac{w_t}{(1+r)^{t'}},$$

where $w_t$ is labor income on date $t$. Above, I have assumed that the initial assets are $a_0 = 0$.

(a) Derive the certainty equivalent consumption function

$$c_0 = \frac{r}{1+r} E_0 \sum_{t=0}^{\infty} \frac{w_t}{(1+r)^t}.$$ 

(b) Suppose labor income follows the autoregressive process

$$w_t = \rho w_{t-1} + \varepsilon_t$$

where $E_{t-1} \varepsilon_t = 0$ and $0 \leq \rho \leq 1$. Solve for $c_0$ in terms of $w_0$, $r$, and $\rho$.

(c) Use your consumption function to solve for the (unconditional) variance of $c_0$, $\text{Var}(c_0)$, as a function of $\text{Var}(w_0)$.

(d) Can you show that for $\rho < 1$, $\text{Var}(c_0) < \text{Var}(w_0)$? Interpret this inequality.

(e) What happens when $\rho = 1$?