You are expected to answer all parts of all questions. If you cannot solve part of a question, *do not give up*. The exam is written so that you should be able to answer later parts even if you are stumped by earlier parts.

Write all answers on the exam itself; if you run out of room, use the back of the previous page.
1. Saving Dynamics Before and During the Great Recession. (Carroll, Slacalek, and Sommer (2012))

Figure 1 shows that the U.S. personal saving rate increased sharply at the beginning of the Great Recession and remained near that new level thereafter. This question asks you to use a model to think about possible reasons for the increase in saving. For each idea adumbrated below, assume that before the beginning of the Great Recession the economy was at its steady-state target. Show how the theory would indicate that the phase diagram changes, and show the dynamics of and following the shock.

a) The first theory is that there was an increase in the degree of unemployment risk.

An increase in \( \bar{\bar{U}} \) increases the target level of assets; to achieve this higher target, it is necessary for consumers to cut consumption for a while so that they can build up their assets. Thus, the short-run consequence is an immediate drop in the level of consumption. In the medium run, consumption growth will be faster, and in the long run consumption will asymptote into a higher level reflecting the larger equilibrium income on the larger stock of assets. This exercise is conducted in Carroll, Slacalek, and Sommer (2012).

Figure 1  Personal Saving Rate in 2007–2011 and Previous Recessions
saving  Notes: The saving rate is expressed as a percent of disposable income. The figure shows the deviation from its value at the start of recession (in percentage points). Historical Range includes all recessions after 1960q1 (when quarterly data become available).

Sources: U.S. Department of Commerce, Bureau of Economic Analysis.
b) A second theory is that the increase in saving was caused by a big negative shock to wealth.

The consumption function does not change in response to a transitory negative shock to $m$; after the shock, $m$ will evolve back toward its steady state. Consumption will drop upon impact, then asymptote back toward the same level that it had before. Again see Carroll, Slacalek, and Sommer (2012).
Now consider a modification to the model for the purpose at hand: We introduce
an ‘unemployment insurance’ system that guarantees a positive level of income for
unemployed households. In the presence of such insurance, households with low
levels of market resources will be willing to borrow because they will not starve
even if they become unemployed. The effect of this change is simply to induce
a leftward shift in the consumption function by an amount corresponding to the
present discounted value of the unemployment benefit. The consumer will limit his
indebtedness, however, to an amount small enough to guarantee that consumption
will remain strictly positive even when unemployed (this requirement defines the
‘natural borrowing constraint’ in this model).

a) Show how the model changes when the unemployment insurance system is
introduced (show the change in the phase diagram as well as the dynamics of
c and m). See Carroll, Slacalek, and Sommer (2012).
b) How might you interpret the long decline in the personal saving rate in the period leading up to 2007 (see Figure 1) using this modified model (hint: the leftward shift in the consumption function is effectively the same thing as an expansion in the credit, because it relaxes the ‘natural borrowing constraint’ that arises from the precautionary saving motive.). See Carroll, Slacalek, and Sommer (2012).
Part II. Short Questions.

1. Pick one of the readings from the “Methodology for Macroeconomists” part of the course and, in a paragraph or two, explain what you think you learned from it. There is no ‘right’ answer to this question. Scores will be judgmentally assigned.
2. Explain *and critique* the argument that the introduction of a Social Security system (a mandatory PAYG pension scheme) reduces the personal saving rate. (By “critique” I mean that you should give at least one well-thought-out *and well-explained* reason why the standard argument might be wrong.)

The analysis for this question is in SocSecAndKAccum. Scores for the critique will be judgmentally assigned, but may include any of the following points:

- The proposition that ‘the introduction of Social Security reduces saving’ is inaccurate because before the Social Security system existed there was effectively a private system that worked the same way: Elderly parents lived with their kids, which meant that there were intergenerational transfers (and expectations of such transfers) that had the same saving incentive effects that Social Security did. Thus the ‘introduction’ of Social Security may not have changed saving because it was just formalizing the existing arrangement.

- Maybe the main reason Social Security was introduced was that there was a lot of evidence that most people were *failing* to save for retirement even though there was NOT a Social Security system. If the previous argument (about an implicit SS system already existing) is ignored, this suggests that people are not forward looking in their saving behavior (they are ‘myopic’), and the model assumes that they are perfectly foresighted.

- In many countries, the financial system at the time the Social Security system is introduced is not sophisticated enough (or trustworthy enough) for the population to be willing to trust it to safely allow them to accumulate assets amounting to several times worth their income and then gradually draw down those assets in old age. (Think Argentina, or Greece, or many countries where the government has effectively confiscated financial assets from households via inflation, financial repression, or other means). For people in those countries, it might be foolish to save for your own retirement because the likelihood is that the government will get the money anyway.

This does not exhaust the list of potential good answers. These are only some examples.
3. Explain why the assumption of ‘growth impatience’ is needed in order for a target \( m \) ratio to exist in the tractable buffer stock model.

A consumer who is ‘growth patient’ or ‘growth poised’ will save so much that wealth heads to infinity. There is thus no ‘target’ \( m \).
4. For a consumer with Constant Absolute Risk Aversion utility, calculate the expected change in consumption if \( \alpha \) is not equal to 1. Discuss why the long-run implications of this result are disturbing for either return-patient or return-impatient consumers in an infinite-horizon framework.

CARA utility is \( U(c) = -\alpha^{-1}e^{-\alpha} \) so \( U(0) = e^{-\alpha} \).

\[
\begin{align*}
(t_t) &= (t_{t+1}) \\
e^{-\alpha_t} &= e^{-\alpha_{t+1}} \\
-\alpha_t &= (-) - \alpha_{t+1} \\
\Delta t_{t+1} &= (-)/\alpha
\end{align*}
\]

The model says that the absolute change in the level of consumption is the same in every period, and is either a positive or a negative number. If the consumer is return impatient (\( > \)) then this implies that from any starting point, consumption will asymptote to negative infinity. If the consumer is return patient, it will asymptote to positive infinity. Neither of these is a useful answer, in a modeling sense.
References