PART 1: Multiple Choice

Choose the correct answer from those provided for each question.

1. Which of the following strike-slip faults is not found in the San Francisco Bay area?
   ( Calaveras / San Jacinto / Hayward )

2. Which of the following normal faulting environments is directly related to subduction?:
   ( mid-ocean ridge / intracontinental rifts / back-arc basins )

3. Which of the following earthquakes does not belong in the same category as the others?:

4. Which of the following slip rates is accurate for the Lost River fault at Borah Peak?:
   ( 0.3 mm/yr / 30 mm/yr / 300 mm/yr )

5. Which type of fault typically does NOT exhibit a sinuous or irregular surface trace (think about the fault “corrugation” effect):
   ( strike-slip / normal / reverse )
6. Which of the following earthquakes did NOT occur in the Los Angeles Basin?:

   ( Northridge / Whittier Narrows / Sylmar / Fort Tejon )

7. How many faults have been identified in the Los Angeles Basin that are capable of producing an earthquake with $M > 6$?:

   ( >100 / 30-50 / ~10)

8. Which of the following parameters does not have an impact on the size of earthquakes along subduction zone megathrusts?

   (age of ocean crust / width of accretionary wedge / subduction rate)

9. In paleoseismology, an earthquake-related feature that formed at some time after the earthquake happened is called a delayed-response feature, or a/an ______________ feature.

   ( nonseismic / coseismic / aseismic )

10. Offset drainages produced by ancient earthquakes along active faults are a type of feature that falls into the following category:

    ( stratigraphic / geomorphic / colluvial )

10. The uppermost stratigraphic layer that exists at the exact instant that an earthquake occurs is referred to by paleoseismologists as the:

    ( event horizon / erosional surface / scarp )
PART 2: Fill in the blanks (20 points)

1. The type of fault geometry in which fault segments are arranged in a staggered manner (similar to this: \ \ \ \ \ ) is called an __________________________ pattern.  

2. What sense of step (left-stepping or right-stepping) will create extension in the stepover zone along a left-lateral fault system? __________________________ 

3. The process by which a major earthquake along a fault causes a later earthquake along a nearby fault (sometimes years later) is called _______________________.

4. The main earthquake-producing fault in Turkey that was responsible for the 1999 Izmit earthquake (M7.4) is called the __________________________ fault.

5. The type of valley produced as a result of two normal faults dipping towards each other on either side of the valley is called a ___________________________.

6. The greatest earthquake risk in the continental USA associated with an intracontinental rift zone occurs along the __________________________ mountain range, thus affecting the major urban area of ____________________________ (name of city).

7. The process by which a number of fault segments can “feel” each other and act like a “team” to accommodate slip along a fault zone is called ___________________________.

8. Reverse faults that do not extend all the way to the Earth’s surface and which do not produce surface ruptures are called ___________________________.

9. Reverse fault segments are commonly connected by a smaller strike-slip fault called a ___________________________.

3
PART 3: Short Answer Topical Questions

1. SAN ANDREAS FAULT SYSTEM (20 points)

1. Describe the tectonics of the San Andreas fault system (i.e., what plate motions are accommodated by the fault) and explain why the SAF is a type of transform fault. (4)

2. List the three major earthquakes that occurred along the San Andreas fault between 1850 and 1990 (indicate year, location, and name of earthquake). (6)

3. The San Andreas fault is part of a system of faults that include several strike-slip faults in the San Francisco Bay area and many faults along the Eastern California Shear Zone. List at least two major historic earthquakes that occurred along these subsidiary faults associated with the SAF system. (2)

4. Were all the recently active strike-slip faults in the Mojave Desert (Eastern California Shear Zone) identified and mapped prior to recent earthquakes, and if not, why not? (4)

5. What is meant by the "Big Bend", what is the state of stress there, and why is it significant for earthquake hazards in the northern Los Angeles Basin? (4)
2. THE 1983 BORAH PEAK EARTHQUAKE  

a) Why is the Borah Peak region prone to normal fault earthquakes? (4)

b) Examine the surface rupture trace map for the Borah Peak earthquake below and answer the following questions.

i) Label the approximate locations of the following on the map:

1: The location of sympathetic rupture caused by ground shaking
2: Chilly Buttes liquefaction/sand blow site
3: A salient across the fault zone
4: A major left step along the Lost River fault that stopped rupture
5: The site of a landslide that occurred after the earthquake (10)

ii) Although the earthquake showed mostly a normal fault plane solution, there was some component of left-lateral slip. Use arrows to indicate the orientation of the maximum extension direction (the direction of $\sigma_3$) on the map. (2)

iii) Based on the known recurrence intervals along the earthquake segments of the Lost River fault, circle the region of the fault that is likely to rupture next. (2)

c) Is segmentation along the Lost River fault always at the same scale? Justify your answer with a description of your observations during the field trip. (6)

d) Describe some of the effects of groundwater flow caused by the earthquake, and explain why earthquakes are able to affect the groundwater system. (6)
Mark the above map with a circled number indicating the locations of the features listed below:

1. San Andreas fault
2. An intracontinental rift system
3. A region of normal faulting produced by a hotspot
4. A back-arc basin
5. A region of extension in a high plateau created by plates colliding
6. A region dominated by thrust faulting (NOT a subduction zone megathrust)
7. The location of the largest earthquake-producing continental décollement
8. A Mariana-type subduction zone
9. The location of the largest earthquake ever recorded
10. The location of a M6.4 earthquake on May 1st 2003 that killed >150 people
PART 5: Choice Question  

Write a one page, **detailed** mini-essay about a topic of your choice from the course material covered during the entire semester. Make sure it is a topic that you can adequately write a full page about (e.g., a specific earthquake event; a process important for earthquake behavior; a summary of what you learned during the field trip; the joys of being a paleoseismologist; or whatever you want!).  

(20 points)