

Open book / open notes. Please answer questions 1, 2, and 3 on separate paper. The number in parentheses show points for each question. Fifty-five minutes maximum time, so pace yourself!

1. (15) In Charles Mann's essay, we read "*Homo sapiens* will keep growing in number, as everyone agrees, and that growth may have disagreeable consequences. But those consequences seem less likely to stem from environmental collapse the apocalyptists predict than from the human race's perennial inability to run its political affairs wisely."

- a. What does Mann mean when he writes "disagreeable consequences?"
- b. Do you agree or disagree with the full statement given above? Provide at least one specific example to support your stand.

2. (15) a. Briefly describe Seattle's physical environment and environmental history.

b. Name three of the most significant natural hazards in the Seattle area. What is the physical source of these hazards? Describe the evidence that suggests these hazards are likely to lead to future disasters.

c. What kinds of rules and regulations are contained in the King County Sensitive Areas Ordinance?

d. On what basis might the ordinance be unconstitutional?

3. (15) Name three geophysical techniques used to understand better physical conditions in the shallow subsurface. For each method you list, briefly describe how it works, what kind of information it provides, and give one or two applications on how it might be used to help solve an environmental problem.

4. (20) About 500,000 acres of rangeland in southwest North Dakota are susceptible to invasion by leafy spurge (*Euphorbia esula* L), a relative of poinsettia. This species secretes toxins that kill surrounding valuable forage and sickens cattle if ingested. On average, each year leafy spurge increases its expanse by 25%.

If 50,000 acres of rangeland are currently covered by leafy spurge, how many years will it take before all the susceptible range land (500,000) is infested, assuming the rate of invasion given above remains constant? Please show your work.

5. (10) A map has a scale of $1:63,360$. An inch on the map shows a distance of _____ mile(s) on the ground.

6. (10) Put an "x" in *section 22* of the township map shown below.

7. (15) As the environmental and emergency manager for a small community in the Seattle area, you received a \$750, 000 FEMA grant to retrofit homes with simple items to lessen seismic damage during an earthquake. You need to use the following information to guide your decision on how to spend the money:

	average parts	ave. cost for	ave. damage cost
item	cost (\$)	installation	reduction per home
water heater tie down straps	16	51	2300
furnace duct boot	27	175	1700
chimney sleeves	25	535	3570
exterior masonry reinforcement	25	750	5267

There are 950 homes in the community, all of which could benefit from each of the four items. Although up to three items can be used in each house, no more than \$1,000 can be spent on retrofitting any one house.

Think about how you would use SOLVER to help you determine the most effective way to spend the grant funds. Carefully **explain or define** what you would use for the following parts of the SOLVER set up –

a. decision variable or changing cells

b. target cell or objective function

c. constraints