

Appendix B

Quantitative Critical Thinking Skills Test (UF/CTS)

Directions: Read each question carefully. For each question, please select the ONE best answer. After you select your answer, indicate how confident you were about this answer.

Read the following passage from the *Biotechnology Industry Organization* to answer Questions 1-4.

We have always relied on living things for food, shelter, clothing and fuel. Our demand for these resources will increase as the world's population grows. In 1900 the global population was approximately 1.6 billion. Now, at the beginning of a new century, this number has surged to 6 billion, and the United Nations estimates that the global population will reach 10 billion by 2030. Agricultural biotechnology can help us meet ever-increasing needs by increasing yields, decreasing inputs such as water and fertilizer, and providing pest control methods that are more compatible with the environment.

1. Which of the following statements from the above excerpt might cause you to agree with the opinion of the Biotechnology Industry Organization?
 - A. "We have always relied on living things for food, shelter, clothing and fuel."
 - B. "In 1900 the global population was approximately 1.6 billion. Now, at the beginning of a new century, this number has surged to 6 billion, and the United Nations estimates that the global population will reach 10 billion by 2030."
 - C. "Agricultural biotechnology can help us meet ever-increasing need by increasing yields..."

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

2. Which of the following statements would best summarize the intent of the passage?
 - A. Biotechnology can help the world survive by feeding the masses of people and protecting the environment.
 - B. Biotechnology is necessary if we want have a safe food supply.
 - C. Biotechnology offers little support to a world with such fast population growth.

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

3. Which of the following reasons would **NOT** support the intent of the passage?
 - A. Increased production of food, shelter, clothing, and fuel supplies is still necessary.
 - B. The environment is in no real danger.
 - C. Agricultural biotechnology should be investigated as a solution.

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

4. Which of the following definitions would best describe transgenics?
- The application of scientific knowledge to transfer beneficial genetic traits from one species to another to enhance or protect an organism.
 - The application of technology to agriculture.
 - A manner of accomplishing a task especially using technical processes, methods, or knowledge.

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

Read the following statistics to answer Questions 5-7.

- The United Nations Food and Agriculture Organization estimates that 13% of the world's population lacks access to adequate amounts of food.*
- According to the World Health Organization, 10% of all children that are born die of starvation.*
- According to Worldwatch Institute, 60% of all newborns in India would be in intensive care if they were born in California.*

5. Assuming that each of the above statistics cited by the Alliance for Better Foods are true, would you say the statement, "Vitamin A deficiency is a widespread problem and a major contributor to child mortality" is:

- Probably True
- Probably False

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

6. If you worked for an International hunger organization, and were trying to acquire funding for research for genetically modified sweet potatoes, how beneficial would the statistics above be in helping you make your argument?
- Not very valuable because sweet potatoes research wouldn't have much to do with starvation and child malnutrition.
 - Very valuable as sweet potatoes have been linked to increased protein intake.
 - Very valuable as sweet potatoes have been linked to correcting Vitamin A deficiencies.

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

7. Which of the following findings may **not** help an argument for sweet potato research to aid world hunger?
- Sweet potatoes can be modified for beta-carotene enrichment to correct for Vitamin A deficiency.
 - The beta-carotene in sweet potatoes may be a factor in reducing the risk of cancer.
 - The sweet potato provides 42 percent of the Recommended Daily Allowance (RDA) for vitamin C and 6 percent of the RDA for calcium

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

Read the following passage to answer Questions 8-10.

In countries of Southeast Asia, Africa, and Latin America rice is a primary component of the diet. However, polished rice is extremely deficient in vitamin A and thus researchers estimate that 124 million children are deficient in vitamin A. This deficiency can cause blindness, exacerbate conditions such as diarrhea, respiratory diseases, and measles and increases childhood mortality. Through genetic engineering scientists have produced a line of rice, called *golden rice*, that may help combat this deficiency by providing 25% of a person's required vitamin A.

8. Which of the following conclusions is probably correct?

- A. This technology, although it only provides 25% of a person's vitamin A, should be made available to these countries as part of an effort to bolster vitamin A consumption.
- B. The scientists that created this technology are just looking to exploit these countries and make a profit.
- C. Since genetic engineering is not natural it should be banned.

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

9. Some groups are against the use of, and distribution of this rice. Most of these groups probably would *not* agree that:

- A. Since the technology cannot provide 100% of a person's vitamin A requirement, why subject them to a genetically engineered food.
- B. This technology, along with education and the availability of vitamin supplements, should be an important part of a strategy to combat vitamin A deficiency.

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

10. Which of the following bits of information could best strengthen the above argument?

- A. Citations, which support the claims.
- B. A physical description of *golden rice*.
- C. The exact amount of vitamin A that is needed in a person's diet.

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

Read the following information to answer Questions 11 & 12

Karen and Jim Wilson, owners of Wilson Farms, began growing cotton in 1988. Karen, an avid environmentalist, became increasingly concerned about the amount of pesticide being used on their crop. In 1995, she heard about a new cotton variety that resists insect damage because scientists used biotechnology to insert a gene from a soil bacterium called *Bacillus thuringiensis* or *Bt*. *Bt* has been used for years as an applied insecticide on organic farms, so its safety for the environment and humans is well understood. Even though the new seeds cost considerably more than the traditional variety, Karen convinced Jim that the *Bt* cottonseeds would, in time, pay off by reducing the financial burden of chemical pesticide sprays. Jim agreed to try out the new seeds at the start of the 1996 season.

The graph on the next page represents the amount of money (in U.S. dollars) the Wilson's spent yearly on *Bt* cottonseeds and insecticides in 1988, 1990, 1992, 1994, 1996, 1998, 2000, and 2002.



11. Which of the following could have the greatest influence on Karen's argument that the *Bt* cottonseeds would, in time, pay off by reducing the financial burden of chemical pesticide sprays?

- A. Average **net** income from cotton each year
- B. Average **gross** income from cotton each year
- C. Average land cost per acre

0 1 2 3 4 5 6 7 8 9 10
not confident at all extremely confident

12. Given all the information in the passage and in the chart, which of the following statements is most correct?

- A. Karen is incorrect in her claim that the new line of seeds would be more profitable than the traditional variety because, even though less money is being spent on pesticides, the new seeds cost more.
- B. Although the cost of the new seeds is more than the cost of the traditional variety, the amount spent on pesticides has decreased since the inception of the new seeds.
- C. Financially speaking, the Wilson's should go back to using the traditional variety of cottonseed.

0 1 2 3 4 5 6 7 8 9 10
not confident at all extremely confident

Read the following passage to answer Questions 13 & 14.

Lily and Kevin are neighbors and both have small backyard gardens. Each claims that his/her garden is organic. One day while working in their gardens, they got into a debate:

“How can you call your garden “organic?” Kevin asked.

Shocked, Lily replied, “What do you mean? I don’t use any chemicals what so ever!”

Kevin answered, “Maybe not, but the seeds you are using are a product of biotechnology. They were genetically engineered to produce toxins to resist insects.”

“Both of our gardens use *Bacillus thuringiensis* for protection,” Lily exclaimed, “the only difference is that you have to apply it regularly as a powder and my plants produce it themselves.”

13. Who would most likely say that biotechnology is unnatural?

A. Lily

B. Kevin

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

14. Which of the following processes would allow Kevin and Lily to find out which of their gardens contain the most harmful pollutants?

A. Set up an experiment and compare the amount of vegetables produced

B. Gather a cup of soil from each garden and examine with the naked eye

C. Set up an experiment and test for pollutants with a soil test kit.

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

Read the following passage to answer Questions 15 & 16.

In 2002 many African countries experienced a severe drought leading to widespread famine among their people. In an effort to help, the United States shipped thousands of pounds of grain to help provide food for the people. Unfortunately, the governments in some of these countries refused to distribute the grain because some of it was genetically modified and this technology had not been approved for use in these countries.

15. Based on the above information you can conclude that:

A. These governments do not want to accept outside help.

B. These governments are afraid that this grain may not be safe for their people and environment.

C. These governments believe that biotechnology is wrong.

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

16. Below is a list of possible solutions to the problem. Which solution would probably allow the United States the greatest likelihood of helping?
- A. Find out how government officials are defining genetic modification and then help them identify the grain products that could still meet their approval.
 - B. Inform the African countries that did not distribute the grain that they would not be receiving any more assistance if they do not distribute the grain.
 - C. Deceitfully try to explain to the countries that there has been no genetic modification in the grain that has been shipped.

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

Read the following passage to answer Question 17.

A study published by scientists at Cornell in the journal *Nature* reported that monarch butterfly populations were endangered by Bt corn pollen. Many researchers questioned the methods and results from the study and subsequent studies were performed to better understand the risks posed to monarchs by Bt corn. The studies concluded that Bt corn presented no greater risk to monarchs than traditional agricultural crop protection methods with less than a 1% chance of a monarch coming in contact with toxic levels of Bt corn pollen under field conditions.

17. After reading the above statement you can conclude that:
- A. The scientists at Cornell University are against biotechnology and published this paper in order to create sympathy for their views.
 - B. The researchers that questioned the results of the original *Nature* article had personal grudges against the Cornell Scientists.
 - C. Although it was concluded that there was no severe danger to monarchs from Bt corn, it is important to consider non-target organisms when introducing new technology.

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

Read the following passage to answer Question 18.

A recent poll showed that 93% of Americans favor labeling genetically engineered products, and 57% stated that they would use labeling to avoid purchasing products containing these products. The FDA has taken the position that labeling is not necessary because there is no evidence that genetically engineered crops change food quality or safety. The American Medical Association also released a report that stated there was "no scientific justification for special labeling of genetically modified foods, as a class."

18. Based on the above statement you can conclude that:
- A. The government does not support labeling because it is afraid people will be scared of this technology if it is labeled.
 - B. The American people have a high perception of risk associated with genetically engineered products.
 - C. Americans think too much.

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

19. There has been concern that genes inserted into crops through genetic engineering may outcross with wild relatives and produce *superweeds*. Based on this information, which of the following would be most correct?

- A. Superweeds are plants that may cross with genetically modified crops and become nuisances.
- B. Superweeds have the potential to take over the world.
- C. The threat of outcrossing from genetically engineered crops has been greatly exaggerated.

0 1 2 3 4 5 6 7 8 9 10
not confident at all extremely confident

20. "Plant genetic engineering is the result of stably inserting a gene from any organism into plant cells that will be properly expressed to produce a protein of interest."

Based on the above statement, which of the following is true?

- A. The gene code is universal, working the same in all organisms to express a protein.
- B. Genes produce only non-protein products.
- C. Genetic engineering works when genes are only temporarily incorporated into cells.

0 1 2 3 4 5 6 7 8 9 10
not confident at all extremely confident

Use the following information to answer Questions 21 & 22

Michelle discovers that the tomato she has just purchased was genetically engineered to express a gene from an animal. Since she is a vegetarian, Michelle cries, "I can't eat this, its not right!"

21. Based on Michelle's statement, which of the following *cannot* be true.

- A. Michelle feels passionately about the benefits of biotechnology.
- B. Michelle is not in favor of the transfer of animal genes into plants.
- C. Michelle believes eating a plant that contains one animal gene is equivalent to eating meat.

0 1 2 3 4 5 6 7 8 9 10
not confident at all extremely confident

22. Michelle seemed surprised to learn that the tomato had an animal gene inserted into it. Which of the following options would have resulted in Michelle being the most aware of what she had just purchased?

- A. A sign over the tomatoes that read "These tomatoes have been genetically altered."
- B. A label on each tomato that stated that it was genetically engineered to carry an animal gene.
- C. A brochure by the tomato display that described how plant genetic engineering was performed

0 1 2 3 4 5 6 7 8 9 10
not confident at all extremely confident

Read the following passage to answer Question 23-25.

Genetic engineering of plants is relatively inefficient. Therefore an antibiotic resistance gene is commonly linked to the gene of interest for insertion into plant cells. Expression of the antibiotic resistance gene allows those cells that receive the gene to be resistant to a particular antibiotic and therefore survive while the non-engineered cells die. This selection process increases the chance that surviving cells also have the gene of interest. However, some people have questioned whether these antibiotic resistance genes are safe for consumption. They ask whether the antibiotic resistance gene could be transferred from the plant into humans or animals and render certain antibiotics useless for health care.

23. To alleviate this concern, what type of research would *not* be helpful:

- A. Examining genes that confer resistance to antibiotics that are no longer important for medical or veterinary treatment.
- B. Inserting multiple antibiotic genes so that the plant produces several different antibiotics at the same time.
- C. Testing the effectiveness of genes that occur in natural microbial populations to which people and animals are already exposed.

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

24. Jim and Karen were food shopping. Jim said to Karen, "We should choose this soy milk because it says it is GMO free." "GMO free" means the soy milk:

- A. Contains no genes.
- B. Is non-allergenic.
- C. Was not made from genetically engineered soybeans.

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

25. Consider the following statement, "Europeans are much more fearful of biotechnology and less accepting of the potential benefits than Americans." Which of the following pieces of information would **best** support that statement?

- A. Prince Charles stating that biotechnology is like playing God.
- B. A research report indicating that the use of genetically engineered crops in the US has steadily risen since their introduction and such crops cannot be exported to many European countries.
- C. A comment from your history professor that most Americans over the years have been pro technology.

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

26. “Studies that have examined the opinions of scientists and the general public have shown that although some people fear that plant biotechnology may have negative consequences, many scientists believe that it can increase agricultural production, be more environmentally–friendly, produce healthier foods, and provide a source for effective pharmaceuticals.”

Which of the following sentences is most like the one above?

- A. People who are against plant biotechnology are wrong because science has proven that it is beneficial.
- B. Despite the fact that many scientists support plant biotechnology, research has shown that a portion of the public remains skeptical about its safety.
- C. Research has proven that plant biotechnology has benefits and drawbacks.

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

Read the following headline to answer Question 27 & 28

Consider the following headline in your local newspaper; “Genetically engineered corn unapproved for human consumption found in taco shells”.

27. The reader probably assumes that this corn:

- A. Is unsafe for humans to eat.
- B. Was also unapproved for animals.
- C. Would be approved for human consumption after testing.

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

28. What is the most probable intent of the author in the above statement?

- A. To support the use of biologically engineered corn products
- B. To make the public apprehensive about *bt* products
- C. To get readers to think about the advantages of agricultural biotechnology.

0	1	2	3	4	5	6	7	8	9	10
not confident at all									extremely confident	

Read the following passage to answer Question 29 & 30 on the next page

You are an environmentally conscious business entrepreneur and a salesperson from *BioCorp* has stopped by to solicit the company’s most recent biodegradable plastic packaging product. From the time he arrives at your place of business he has done nothing but praise the environmental benefits of his new product. He actually said, “It is the best *green* product industry he has ever seen.” He cites the following reasons for considering the biodegradable plastics: (1) *It is derived from vegetable starch*, (2) *It can dissolve into water and carbon dioxide within an hour*, and (3) *it can save the earth*.

29. Which of the following is probably an unstated assumption regarding the salesman's statements and claims?
- A. His biodegradable plastic product dissolves quickly.
 - B. He believes in his product.
 - C. He needs to make a sale.

0 1 2 3 4 5 6 7 8 9 10
not confident at all extremely confident

30. Which of the above claims made by the salesman would be the **most difficult** to prove?
- A. It's the best *green* product the industry has ever seen.
 - B. It can dissolve into water and carbon dioxide within an hour.
 - C. It can save the earth.

0 1 2 3 4 5 6 7 8 9 10
not confident at all extremely confident

Demographics

31. What is your age? _____
32. Gender: (Circle one) Male Female
33. Ethnic Origin: _____
34. What is your major? _____
35. What is your GPA? _____
36. Are you from a(n): _____
- a. Rural area- <2,500 population
 - b. Small sub-urban area – 2,501-25,000 population
 - c. Large sub-urban area – 25,001 - 100,000
 - d. Urban area – over 100,000
37. Are you in the honors program? (Circle one) Yes No

Thank you

Suggested citation

Irani, T., Rudd, R., Gallo, M., Ricketts, J., Friedel, C., & Rhoades, E. (2007). Critical thinking instrumentation manual. Retrieved month day, year, from http://step.ufl.edu/resources/critical_thinking/ctmanual.pdf.

Appendix C

Quantitative Skills Instrument (UF/CTS) Scoring Rubric

Item	Construct and Code	Item Statement Analyzed
1.	Analysis	B.
2.	Analysis	A.
3.	Analysis – Recoded	B.
4.	Analysis	A.
5.	Evaluation	A.
6.	Evaluation	C.
7.	Evaluation – Recoded	B.
8.	Inference	A.
9.	Inference	B.
10.	Evaluation	A.
11.	Evaluation	A.
12.	Analysis	B.
13.	Evaluation	B.
14.	Inference	C.
15.	Evaluation	B.
16.	Inference	A.
17.	Inference	C.
18.	Inference	B.
19.	Analysis	A.
20.	Evaluation	A.
21.	Evaluation – Recoded	A.
22.	Inference	B.
23.	Inference – Recoded	C.
24.	Inference	C.
25.	Analysis	B.
26.	Analysis	B.
27.	Inference	A.
28.	Analysis	B.
29.	Analysis	C.
30.	Evaluation – Recoded	C.