Disease Detectives

2017 Golden Gate Science Olympiad Invitational Disease Detectives Test

Time limit: 60 Minutes

Names:_____

Team Number:_____
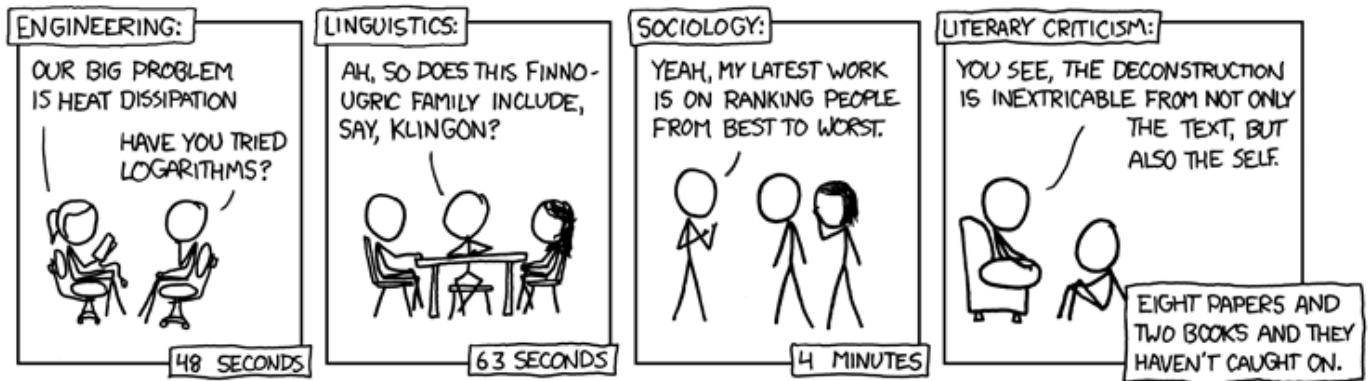
School:_____

(*For Grader's Use Only*)

Score: / 264

Rank:

Part One (66 points)

(1 point each, 66 points total) (Each term will be used only once)

Active Immunity	Acute Exposure	Agent	Antigen	Secondary Attack Rate	Information Bias	Selection Bias
Crude Birth Rate	Index Case	Necessary Cause	Class Interval	Comparison Value	Confounding	Delayed Health Effect
Detection Limit	Dose-Response Relationship	Efficacy	Efficiency	Endemic Level	Epidemiologic Trial	Analytic Epidemiology
Applied Epidemiology	Descriptive Epidemiology	Exposure-Dose Reconstruction	Fomite	Health Promotion	Healthy Worker Effect	Host Factor
Active Immunity	Herd Immunity	Passive Immunity	Incidence	Incubation Period	In Vitro	In Vivo
Crude Mortality Rate	Infant Mortality Rate	Neonatal Mortality Rate	Postneonatal Mortality Rate	Normal Distribution	Odds Ratio	Outbreak
Common-Source Outbreak	Point-Source Outbreak	Propagated Outbreak	Pandemic	Prevalence	Reservoir	Risk Communication
Random Sample	Representative Sample	Standard Deviation	Analytic Study	Case-Control Study	Cohort Study	Experimental Study
Observational Study	Medical Surveillance	Passive Surveillance	Sentinel Surveillance	Synergistic Effect	Teratogen	Airborne Transmission
Vectorborne Transmissions	Vehicleborne Transmissions	Virulency				

A.   The systematic assessment of people exposed or potentially exposed to health hazards. _____

B.   Manipulation of the association between an exposure and a health outcome by a third variable that is related to both._____

C.   The immunity that results from the production of antibodies by the immune system in response to the presence of an antigen. _____

D.   The number of deaths of children from birth up to, but not including, 28 days per 1,000 live births. _____

E.   Contact with a substance that occurs once or for only a short time. _____

F.   A study that evaluates the association between exposure to hazardous substances and disease by testing scientific hypotheses. _____

G.   Selected reporting units, with a high probability of seeing cases of the disease in question, good laboratory facilities and experienced well-qualified staff, identify and notify on certain diseases. _____

H.   A toxin or other foreign substance that induces an immune response in the body, especially the production of antibodies. _____

I.   The probability that infection occurs among susceptible persons within a reasonable incubation period following known contact with an infectious person or another infectious source. _____

J.   Bias arising from measurement error. _____

K.   The choice of individuals, groups or data for analysis in such a way that proper randomization is not achieved. _____

L.   Gathers disease data from all potential reporting health care workers without prompting. _____

M.   The number of live births occurring among the population of a given geographical area during a given year, per 1,000 mid-year total population of the given geographical area during the same year. _____

N.   A measure that is used to quantify the amount of variation of a set of data values. _____

O.   The initial patient in the population of an epidemiological investigation, or more generally, the first case of a condition or syndrome to be described in the medical literature. _____

P.   A study that samples a group of people who share a defining characteristic, typically who experienced a common event in a selected period. _____

Q.   A factor that must be present for a disease to occur. _____

R.   A factor (e.g., a microorganism or chemical substance) or form of energy whose presence, excessive presence, or in the case of deficiency diseases, relative absence is essential for the occurrence of a disease or other adverse health outcome. _____

S.   The size of each class into which a range of a variable is divided, as represented by the divisions of a histogram or bar chart. _____

T.   Refers to the degree of damage caused by a microbe to its host. _____

U.   Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful health effects in exposed people. _____

V.   An outbreak in which persons are exposed to the same source over a brief time, such as through a single meal or at an event. The number of cases rises rapidly to a peak and falls gradually. _____

W.   A study that compares exposures of people who have a disease or condition with people who do not have the disease or condition. _____

X.   A disease or an injury that happens as a result of exposures that might have occurred in the past. _____

Y.   The lowest concentration of a chemical that can reliably be distinguished from a zero concentration. _____

Z.   The relationship between the amount of exposure to a substance and the resulting changes in body function or health. _____

AA.   The ability of an intervention or program to produce the intended or expected results under ideal conditions. _____

BB.   The ability of an intervention or program to produce the intended or expected results with a minimum expenditure of time and resources. _____

CC.   The amount of a particular disease that is usually present in a community. _____

DD.   Consists of an external agent, a host and an environment in which host and agent are brought together, causing the disease to occur in the host. _____

EE.   The study of epidemiology that is concerned with the search for causes and effects, or the why and the how. _____

FF.   An outbreak which results from transmission from one person to another. _____

GG.   Putting epidemiological research methods to use in public health practice. _____

HH.   The study of the amount and distribution of a disease in a specified population by person, place, and time. _____

II.   A method of estimating the amount of people's past exposure to hazardous substances. _____

JJ.   Any nonliving object or substance capable of carrying infectious organisms, such as germs or parasites, and hence transferring them from one individual to another. _____

KK.   A study where the researcher observes and systematically collects information, but does not try to change the people. _____

LL.   The process of enabling people to increase control over, and to improve, their health. _____

MM.   A phenomenon where workers usually exhibit lower overall death rates than the general population because

the severely ill and chronically disabled are ordinarily excluded from employment._____

NN.   A biologic response to multiple substances where one substance worsens the effect of another substance. _____

OO.   Refers to the traits of an individual person or animal that affect susceptibility to disease, especially in comparison to other individuals. _____

PP.   The immunity that results from the production of antibodies by the immune system in response to the presence of an antigen. _____

QQ.   A sample whose characteristics correspond to those of the original population or reference population. _____

RR.   The immunity to a pathogen in a population based on the acquired immunity to it by a high proportion of members over time. _____

SS.   A study where the researcher intervenes to change something (e.g., gives some patients a drug) and then observes what happens. _____

TT.   The short-term immunity that results from the introduction of antibodies from another person or animal. _____

UU.   The number of new cases of disease in a defined population over a specific time period. _____

VV.   The period between exposure and onset of clinical symptoms. _____

WW.   The exchange of information to increase understanding of health risks. _____

XX.   In an artificial environment outside a living organism or body. _____

YY.   Infections transmitted by the bite of infected arthropod species. _____

ZZ.   Within a living organism or body. _____

AAA.   The mortality rate from all causes of death for a population during a specified time period. _____

BBB.   The habitat in which an infectious agent normally lives, grows and multiplies. _____

CCC.   The number of deaths of infants under one year old per 1,000 live births. _____

DDD.   A substance that causes defects in development between conception and birth. _____

EEE.   A set of items that have been drawn from a population in such a way that each time an item was selected, every item in the population had an equal opportunity to appear in the sample. _____

FFF.   The number of deaths of children from 28 days up to, but not including, one year per 1,000 live births. _____

GGG.   A function that represents the distribution as a symmetrical bell-shaped graph. _____

HHH.   Infections transmitted by an inanimate object or material. _____

III.   A measure of association between an exposure and an outcome. _____

JJJ.   A sudden increase in occurrences of a disease in a particular time and place. _____

KKK.   An outbreak in which a group of persons are all exposed to an infectious agent or a toxin from the same source. _____

LLL.   An epidemic of infectious disease that has spread through human populations across a large region. _____

MMM.   When bacteria or viruses travel on dust particles or on small respiratory droplets that may become aerosolized when people sneeze, cough, laugh, or exhale. _____

NNN.   The number of existing disease cases in a defined population during a specific time period. _____

Part Two (28 points)

Half of the students living in Berkeley's Adams, James, and Jefferson dorms eat in the President's Dining Hall for their meals, and the other half eat in a dining facility close by. About 700 students live in Adams, 1000 in James, and 850 in Jefferson. Dinner is served from 5:00PM to 7:00PM everyday. Typical meals at the dining hall include burgers, pizza, and french fries, but on special occasions, the dining hall serves the students good food from

restaurants in the surrounding community. On November 10th, 2016, some of the delicacies served were a soft cheese similar to brie, grilled steak with truffle mashed potatoes, and braised rosemary chicken breast. You can assume that all the students who ate at the dining hall ate all of the food provided. After their delicious meal, the Berkeley students returned to their dorms, studied for their classes, and went to bed. Around 8:00AM on November 11th, 30 students in Adams, 55 in James, and 40 in Jefferson came down with symptoms of nausea, diarrhea, fever, and muscle aches. All of these students ate at the President's Dining Hall. Of the students who ate at the other dining facility, which did not have this special dinner, 15 in total came down with these same symptoms. These students visited the University Health Services Center, and were told by the nurses to stay in bed and limit contact with uninfected students. Based on this situation, answer the following questions:

(1) Which food-borne organism **AND** illness do you believe these students were infected with? Support your claim with evidence from the above scenario. (4 points)

Organism: _____

Illness: _____

Evidence:_____
_____
_____

(2) Name two food-borne illnesses that you could have ruled out from evidence provided above. Explain how you were able to rule them out. (4 points) **TIEBREAKER 6**

1:_____
_____
_____

2:_____
_____
_____

(3) Explain why the advice the nurses gave the students at the University Health Services Center does or does not make sense. (3 points)

_____
_____
_____
_____

(4) Calculate the risk ratio for the scenario above. Show the work you did to get to your answer. (6 points)

(5) Interpret the risk ratio you calculated. (3 points)

_____
_____
_____
_____

By coincidence, it happened that a free lamaze class for low income pregnant women was being held in a nearby Berkeley gymnasium from 3:00PM to 5:00PM the same day. About 400 women from around the area attended the class and they were all in their third trimester of pregnancy. When the class ended, every woman was given a free pass to Berkeley's President's Dining Hall for a free dinner that day only. 300 of the women went to dinner that day and ate all of the selections provided. About two and a half weeks later, 150 of these women started to develop flu-like symptoms, but only mild fever and vomiting, akin to morning sickness. Two weeks after these symptoms arose, 50 of these women had sudden miscarriages.

(6) Based on your earlier identification of the food-borne illness, what happened to these pregnant women that had miscarriages? (4 points)

_____
_____
_____
_____

That week was also homecoming week for UC Berkeley and alumni from across the country were coming to revisit their alma mater. The Berkeley Class of 1958's reunion was being held at the reception hall near the President's Dining Hall and their food was being catered by that dining hall the same day as the special dinner, November 10th. The alumni ate all of the food that was catered and several hundred of them had similar symptoms as the students, fever, nausea, muscle aches, diarrhea, and also a stiff neck and sensitivity to light. About 2 months later, a six dozen of these alumni who had these symptoms die.

(7) Based on the above information, what was the likely cause of their death? Provide evidence that supports your claim. (4 points) **TIEBREAKER 4**

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Part Three (55 points)

(1) List the 13 steps of an Epidemiologic Outbreak Investigation. Do your best to put the steps in order, but it is not required. (13 points) **Tiebreaker 5**

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2:_____

3:_____

4:_____

5:_____

6:_____

7:_____

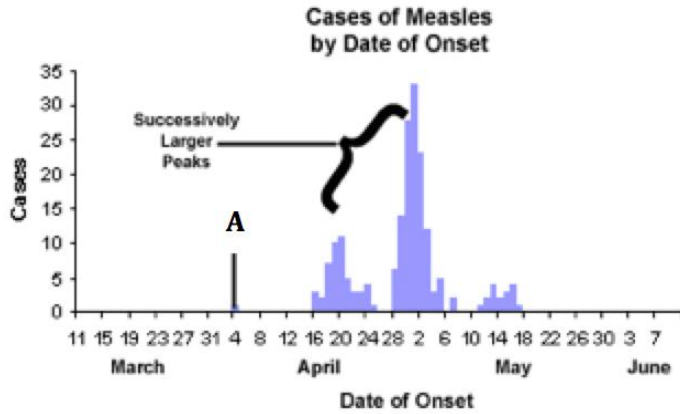8:_____

9:_____

10:_____

11:_____

12:_____

13:_____

(2) When identifying a specific case, what are the three different categories of a case definition that allow for uncertainty, and how do you define each of these categories? (6 points)

1:_____
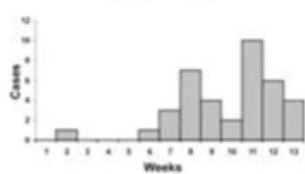_____

2:_____
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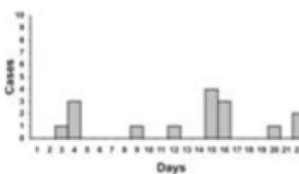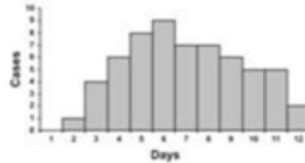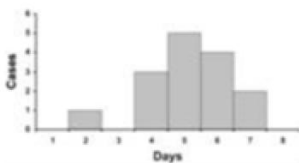3:_____
_____

(3) _____ is the process of characterizing an outbreak by time, place, and person. (2 points)

Cases of Measles by Date of Onset

(4) What type of graph is shown above? (2 points)

(5) On this graph above, what does A indicate? (2 points)

(6) What type of spread is indicated above? (2 points)

(7) Identify each of these graphs for different types of spread: (4 points)

Upper Left: _____

Upper Right: _____

Lower Left: _____

Lower Right: _____

(8) Name and briefly describe the two types of cohort studies: (4 points)

1:_____

2:_____

Brunch'd is a popular brunch destination in downtown Palo Alto, and only a 15 minute bike ride from the Stanford

campus! Frequents of the restaurant are university students as well as Palo Alto community members. In October, 394 people was diagnosed with Salmonellosis and Brunch'd is suspected to be the source. 274 went to Brunch'd and 120 people did not. In addition to the 394 people diagnosed, 612 similar disease-free people were contacted to see if they ate at Brunch'd. 241 people ate at Brunch'd and 371 did not.

(9) What is the type of study you will perform with the information provided? (2 points)

(10) What is the primary fallback from the type of study you listed above? (2 points)

_____
_____

(11) Create a 2x2 table below based on the above scenario: (5 points)

(12) Calculate the odds ratio for the above scenario. Show the work you did to get to your answer. (4 points)
TIEBREAKER 3

(13) Interpret the odds ratio you calculated. (2 points)

_____
_____

(14) Name three symptoms of Salmonellosis and the typical range of incubation period. (5 points)

Symptoms:_____

Incubation Period:_____

Part Four (61 points)

Name the following famous epidemiologists (2 points each):

(1) British physician who developed a critical theory regarding Cholera Transmission and lead to the adoption of anesthesia.

(2) The scientist who was credited with developing the Smallpox Vaccine.

(3) The scientist who developed the vaccine that eradicated polio.

(4) British epidemiologist, regarded as the founder of medical statistics.
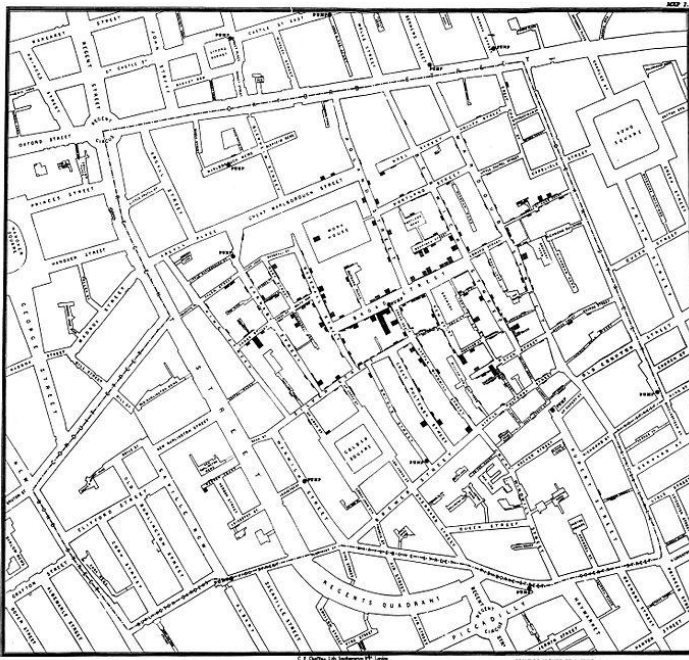
(5) Name the type of map shown above as well as what significant disease outbreak it depicts. (4 points)
TIEBREAKER 2

Type of Map: _____

Disease Outbreak: _____

(6) Clearly circle on the map above the source of this outbreak. (2 points)

(7) Describe the significance of the discovery of this outbreak. (3 points)

_____
_____
_____
_____

(8) Previously, this disease had a debate over the mode of transmission. Explain what this debate was and how the discovery this epidemiologist made ended this debate. (6 points)

_____
_____
_____
_____
_____

(9) Below is a table of various diseases, modes of transmission, and symptoms of the disease. Fill in the blank spaces. (1 point each, 23 points total) **TIEBREAKER 1**

Disease	Transmission	Symptoms	B/V/P
	Tick	Fever, Chills, Headache	
Yellow Fever			
	Zoonosis (Rodents, Rabbits, Insect)	Flu, Pneumonia	
Hepatitis C			
	Zoonosis (Bird bite/air)	Typhoid	
Pertussis			
	Direct Contact/Droplet	Throat/Respiratory	
Tetanus			
Kuru			
Anthrax			
	Direct Contact	Red Rashes or Blister	
Measles			
SARS			
	Aerosol from Infected Water	Pneumonia	
	Tick	Circular Rash, Headache, Fatigue	

(10) Determine if each disease in the above table is from a Bacteria, Virus, or Prion. Write your answer for each disease in the fourth column. (15 points)

Part Five (54 points)

Bias inherently exists in all Epidemiologic studies, and it is important for scientists to identify these sources of bias and attempt to correct them.

Below you will be given various scenarios and you will state the most specific type of bias that is present. Then explain how this bias could have been prevented. (6 points each scenario, 42 points max)

(1) 500 supervisors are selected as a sample and they are questioned about the amount of work they give their employees. The survey is publicly available, with their individual responses identified. The result of the survey had the mass majority of supervisors respond that they give their employees little work.

_____
_____
_____
_____

(2) A case-control study is being performed among a group of people who ate a restaurant that likely served contaminated food. After eating at this restaurant, the people brought leftovers home. The control group selected are the family members of the sick people.

_____
_____
_____
_____

(3) A complete study is performed on California residents who have lung cancer. Biographical and medical information is collected as complete as possible, with 15 different categories per patient. When analyzing the data, it is decided that any patient with information missing in more than 5 categories will be thrown out of the study. About 2000 cases of 14000 ended up being thrown out.

_____
_____
_____
_____

(4) A study is being performed where an interviewer is asking study participants questions about their eating habits. The morning of the study, the intended interviewer was sick and was not able to make it in, so the designer of the study decided to perform the interviews herself.

_____
_____
_____
_____

(5) A study is being performed in which patients infected with Norovirus are asked about when they were exposed and what situations placed them at risk. During these interviews, the interviewer asked the patients about a specific location where they believe the Norovirus to have broken out, and many patients said they went to that location.
TIEBREAKER 7

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_____
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(6) 1000 young college students are interviewed regarding their sexual health and history. One of the questions in the interview asked about their use of protection when engaging in sexual activities with partners. There ended up being an extremely high percentage of students that said they use protection, 85%, whereas the national average for college students is about 60%.

_____
_____
_____
_____

(7) A group of 45 high school students were exposed to whooping cough and contracted the disease. A group of epidemiologists came in from the CDC to investigate the outbreak and interviewed the students about their interactions with other students in an attempt to find the source. Five researchers came in and each student went through five rounds of interviews.

_____
_____
_____
_____

(8) Name three ways confounding can be controlled in a study. Explain how each of these methods reduces an aspect of confounding. (12 points)

1:_____
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