

AP Exam Investigative Tasks



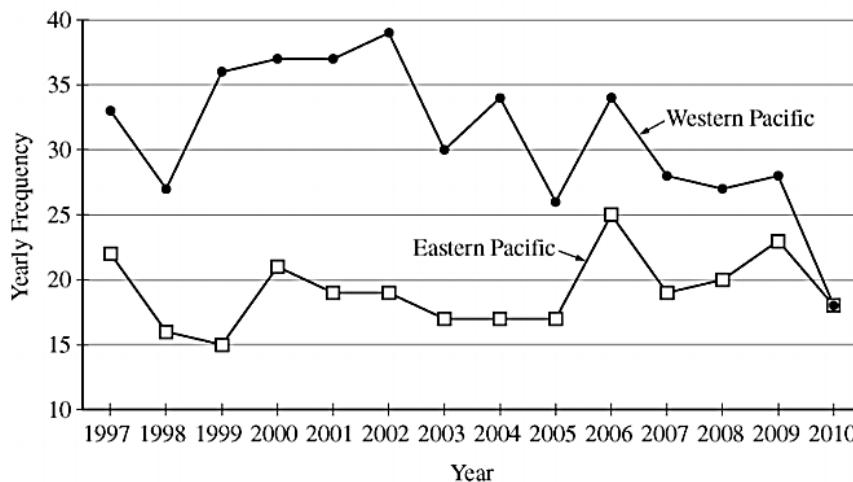
"FRAPPY"

{Free Response AP Problem...Yay!}

The following problem is taken from an actual Advanced Placement Statistics Examination. Your task is to generate a complete, concise statistical response in 25 minutes. You will be graded based on the AP rubric and will earn a score of 0-4. After grading, keep this problem in your binder for your AP Exam preparation.

Tropical storms in the Pacific Ocean with sustained winds that exceed 74 miles per hour are called typhoons. Graph A below displays the number of recorded typhoons in two regions of the Pacific Ocean—the Eastern Pacific and the Western Pacific—for the years from 1997 to 2010.

GRAPH A



Scoring:

E P I

(a) Compare the distributions of yearly frequencies of typhoons for the two regions of the Pacific Ocean for the years from 1997 to 2010.

E P I

(b) For each region, describe how the yearly frequencies changed over the time period from 1997 to 2010.

Total: ___/4

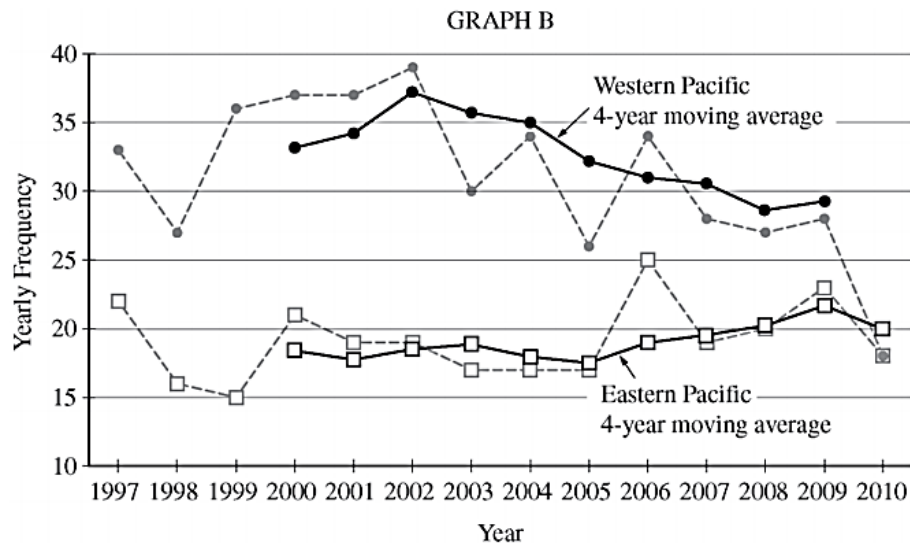
A moving average for data collected at regular time increments is the average of data values for two or more consecutive increments. The 4-year moving averages for the typhoon data are provided in the table below. For example, the Eastern Pacific 4-year moving average for 2000 is the average of 22, 16, 15, and 21, which is equal to 18.50.

Year	Number of Typhoons in the Eastern Pacific	Eastern Pacific 4-year moving average	Number of Typhoons in the Western Pacific	Western Pacific 4-year moving average
1997	22	X	33	X
1998	16		27	
1999	15		36	
2000	21	18.50	37	33.25
2001	19	17.75	37	34.25
2002	19	18.50	39	37.25
2003	17	19.00	30	35.75
2004	17	18.00	34	35.00
2005	17	17.50	26	32.25
2006	25	19.00	34	31.00
2007	19	19.50	28	30.50
2008	20	20.25	27	28.75
2009	23	21.75	28	29.25
2010	18	20.00	18	

(c) Show how to calculate the 4-year moving average for the year 2010 in the Western Pacific. Write your value in the appropriate place in the table.

E P I

(d) Graph B below shows both yearly frequencies (connected by dashed lines) and the respective 4-year moving averages (connected by solid lines). Use your answer in part (c) to complete the graph.



(e) Consider graph B.

E P I

- i) What information is more apparent from the plots of the 4-year moving averages than from the plots of the yearly frequencies of typhoons?
- ii) What information is less apparent from the plots of the 4-year moving averages than from the plots of the yearly frequencies of typhoons?



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Administrators in a large school district wanted to determine whether students who attended a new magnet school for one year achieved greater improvement in science test performance than students who did not attend the magnet school. Knowing that more parents would want to enroll their children in the magnet school than there was space available for those children, the district administrators decided to conduct a lottery of all families who expressed interest in participating. In their data analysis, the administrators would then compare the change in test scores of those children who were selected to attend the magnet school with the change in test scores of those who applied to attend the magnet school but who were not selected.

The tables below show the scores on the same science pretest and the same science posttest for 20 students. Of the 20 students, 8 were randomly selected from the magnet school and 12 were randomly selected from those who applied to attend the magnet school but who were not selected and then attended their original school.

Magnet School		
Pretest Score	Posttest Score	Posttest – Pretest
80	97	17
78	98	20
86	84	- 2
78	79	1
64	89	25
71	77	6
71	83	12
73	88	15
$\bar{x} = 75.125$	$\bar{x} = 86.875$	$\bar{x} = 11.750$
$s = 6.770$	$s = 7.699$	$s = 9.407$

Original School		
Pretest Score	Posttest Score	Posttest – Pretest
83	80	- 3
80	89	9
63	65	2
79	78	- 1
83	93	10
77	79	2
66	70	4
80	84	4
73	80	7
90	90	0
77	78	1
90	91	1
$\bar{x} = 78.417$	$\bar{x} = 81.417$	$\bar{x} = 3.000$
$s = 8.207$	$s = 8.512$	$s = 3.977$

Scoring:

(a) Perform a test to determine whether students who attend the magnet school demonstrate a significantly higher mean difference in test scores (Posttest - Pretest) than students who applied to attend the magnet school but who were not selected and then attended their original school.

E P I

Administrators were also interested in using pretest scores on this test as a predictor of posttest scores on the test. The following computer output contains the results from separate regression analyses on the magnet school scores and on the original school scores. The accompanying graph displays the data and separate regression lines for the magnet and original schools.

Regression Analysis: Post_Magnet versus Pre_Magnet

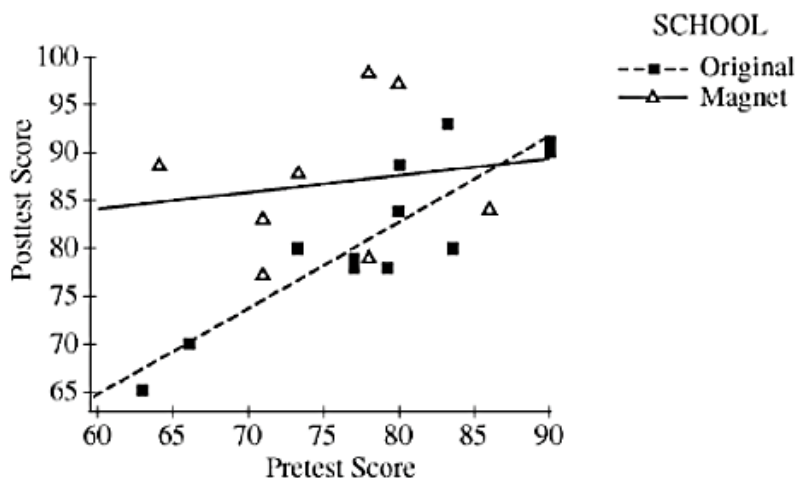
Predictor	Coef	SE Coef	T	P
Constant	73.27	34.55	2.12	0.078
Pre_Magnet	0.1811	0.4583	0.40	0.706

S = 8.20920 R-Sq = 2.5% R-Sq(adj) = 0.0%

Regression Analysis: Post_Original versus Pre_Original

Predictor	Coef	SE Coef	T	P
Constant	9.24	11.91	0.78	0.456
Pre_Original	0.9204	0.1512	6.09	0.000

S = 4.11463 R-Sq = 78.8% R-Sq(adj) = 76.6%



- (b) (i) State the equation of the regression line for the magnet school and interpret its slope in the context of the question.
- (ii) State the equation of the regression line for the original school and interpret its slope in the context of the the question.

E P I

(c) To determine whether there is a significant correlation between pretest score and posttest score, a test of the following hypotheses will be performed.

H_0 : There is no correlation between pretest score and posttest score
(true slope = 0)

versus

H_A : There is a correlation between pretest score and posttest score
(true slope \neq 0)

(i) Using the regression output, state the p -value and conclusion for this test at the magnet school. Assume the conditions for inference have been met.

(ii) Using the regression output, state the p -value and conclusion for this test at the original school. Assume the conditions for inference have been met.

E P I

(d) What additional information do the regression analyses give you about student performance on the science test at the two schools beyond the comparison of mean differences in part (a)?

E P I