US ERA ARCHIVE DOCUMENT

#### DATA EVALUATION RECORD

- 1. Chemical: PP321
- 2. Test Material: PP321, 96.6% w/w Technical Grade
- 3. Study Type: Fish Early Life Stage Toxicity Test

Species Tested: Cyprinodon variegatus

- 4. Study ID: Hill, R.W.; Caunter, J.E.; Cumming R.I. (1985)
  PP321: Determination of the Chronic Toxicity to
  Sheepshead Minnow (Cyprinodon variegatus) Embryos
  and Larvae. Submitted by ICI Americas, Inc.,
  Prepared by Imperial Chemical Industries, PLC,
  Brixham Laboratory, Brixham, Devon. EPA Accession
  No. 073989.
- 5. Reviewed By: Candy Brassard

Environmental Protection

Specialist

EEB/HED

Date:

6. Approved By: Douglas J. Urban Head, Section II

EEB/HED

Signature:

Date:

#### 7. Conclusions:

This study is scientifically sound. However, there are significant data discrepencies, based on lack of raw data, that are outlined in section 14. Specific concerns include: the measured concentrations ranging from only 20 to 64 percent of the nominal; the light intensity and photoperiod varied considerably from the SEP guidelines. Therefore, this study is classified as supplemental.

#### 8. Recommendations:

The raw data are required in order to clarify the data gaps identified in section 14. Repairablity is dependent on the submittal and review of the new information. There are additional concerns for the measured concentrations.

#### 9. Background:

The study was submitted prior to submission of a registration action for Karate on cotton.

10. Discussion of Individual Test: N/A

#### 11. Materials and Methods:

a. Test Animals - Sheepshead minnow embryos were obtained from broodstock held at the Brixham Laboratory. The fish were originally obtained from Sea Plantations, Incorporated, Salem, MA and were held in the laboratory for 9 months prior to the start of the study.

The female gametes were induced by spawning. The ova (after stripping females) were mixed with sperm obtained from macerated excised testes of male fish. Viability was verified after 20 hours.

After the embryos were distributed to embryo cups, they were treated with a 15-second exposure of malachite green, then washed with seawater. Fish were fed Artemia salina and Promin after 11 days (posthatch).

b. <u>Test System</u> - A flowthrough system was used for this study.

[Excerpted from submission]

"The flow of the seawater (salinity 34 +/- 2 °/00) used in this study was controlled by a ball-valve and passed into a storage tank with a constant head. Freshwater, controlled by a flow through glass capillary tube, was also passed to this tank to produce the required salinity.

"The water was pre-heated in the tank and gentle aeration was used to ensure adequate mixing. The dilution water of the required salinity (nominal 25 °/00) was then allowed to flow by gravity to each mixing cell.

"Watson Marlow peristaltic pumps were used to deliver the stock solutions of the test substance to the mixing cells. Independent magnetic stirrers were employed to ensure adequate mixing before the test solutions were fed to the exposure vessels by gravity feed.

"Five nominal concentrations 1.0, 0.56, 0.32, 0.18 and 0.010  $\mu$ g/L of PP321 and separate carrier (DMF) and dilution water controls were used in the study and replicate tanks (A + B) were employed at all concentrations and controls. Glass aquaria measured 30 cm length x 20 cm width x 20 cm depth; an overflow drain was incorporated at the end of each aquarium which maintained a constant test volume of approximately 9 litres. The water depth in each tank was approximately 15 cm.

"The dosing system was designed so that each replicate tank received 100 ml/minute of the required test solution and a further 100 ml/minute ran to waste. At these rates of dosing the calculated number of aquarium volume replacements was 16 per 24-hour period. Further details of the test system are given in Appendix 2.

"Illumination of the test system was provided by four Crompton white fluorescent lights situated directly above the aquaria.

"The photoperiod employed was 12 hours of light at 2800-3300 lux alternating with 12 hours of darkness. Light measurements were determined with a Centronic model 110 photometer."

The dilution water consisted of seawater diluted with freshwater to attain the salinity of 23.5 to 26.7 percent.

Embryo cups were constructed from 8 cm lengths of 5 cm OD transparent plastic tubing and nylon mesh cemented on the base of the cup. The cups were suspended in the test chambers and oscillated vertically over a distance of 2 to 5 cm at a rate of 2 oscillations/minute in the test solutions.

- c. Dose The five nominal concentrations included 1.0, 0.56, 0.32, 0.18, and 0.010  $\mu g/L$  of PP321. A solvent control (DMF) and a control were also included.
- d. Study Design Fifteen embryos were randomly distributed in batches of five into each of 28 embryo incubation cups.

All test solutions were analyzed at the start and finish of the exposure period and alternate replicates were measured twice weekly. All water samples were taken in 250 mL volumetric flasks immersed in tanks below surface of the water.

Percent hatch and percent survival of embryos, and total lengths and weights of larvae were determined at test termination.

e. Statistics - [Excerpted from submission]

"The percentage hatch and survival data were analyzed by one-way analysis of variance (Ref 2). Where the F-statistic was significant at the 5% level Dunnett's t-tests were performed, to compare the treatments against the controls, looking for differences at the 5% and 1% significance levels (Ref 3 and 4). "For the larval length and weight data the replicates in each treatment and in the controls were tested for differences at the 5% level. In the absence of significant differences the replicates for each treatment and the controls were pooled and a one-way analysis of variance carried out. This was followed by Dunnett's t-tests, at the 5% and 1% levels, between each of the treatments and the controls. The relative standard deviations (RSD) of the weights of the two controls were calculated to determine the acceptability of the data according to the EPA Environmental Effects Guidelines (Ref 5)."

# 12. Reported Results: [Excerpted from submission]

# "Hatchability

"The hatchability of sheepshead embryos was not significantly affected (P<0.05) in any replicate test vessel in this study. The percentage hatchability ranged from 81.3 to 100% with an overall mean value of 90.5%. These values were calculated on the number of larvae released. Data obtained on the hatchability are shown in Table 4.

# "Larval survival

"Larval survival was not significantly affected (P<0.05) in any concentration or control. The larval survival for all PP321 concentrations ranged from 75.9 to 93.3% based on the initial embryos exposed. The corresponding values for the carrier (DMF) were 80-86.2% and the dilution water control 83.9-86.7%. Survival data are shown in Table 4.

#### "Larval growth

- "No significant effect (P<0.05) was found in the length data in any concentration of PP321 or in the carrier or dilution water controls at the completion of the study.
- "A significant effect (P<0.05) was found in the weight data at the highest concentration tested (mean measured concentration of 0.38  $_{11}$ g/1 PP321.
- "No significant effect (P<0.05) was found in the weight data for all other PP321 concentrations tested.
- "Larval weights and lengths are shown in Tables 4, 6 and 7.
- "The no observed effect concentration (NOEC) was therefore considered to be 0.25  $_{\mu}$ g/l PP321. The observed effect concentration (OEC) was considered to be 0.38  $_{u}$ g/l PP321.

#### "PP321 analyses

- "Measurements were made on hexane extracts of water samples taken from the exposure tanks.
- "Good correlation was found between replicate tanks and the mean measured value obtained for all measurements was 41% of the nominal exposure concentration value, with a range of values from 36.0 to 46.9% of the nominal levels.
- "Data obtained are shown in Table 3.

#### "Chemical parameters monitored

- "Heavy metals and pesticide concentrations in the seawater and freshwater were in keeping with expected values (Table 2). Analyses of the fish food diets are also given in Table 5.
- "It is considered that none of the contaminants were present in sufficient quantity to have adversely affected the quality of the study.

## "Physical parameters monitored

- "Dissolved oxygen levels ranged from 6.0 to 7.6 mg/l.
- "The pH values ranged from 8.2 to 8.3 pH units.
- "Temperature values ranged from 24.1 to 26.2°C.
- "The data obtained (reported as ranges of values) show little variation during the whole study period (see Table 1).

#### "Statistics

- "The statistics obtained from the data for the hatch, survival, lengths and weight data together with the relative standard deviation of the control fish are shown in Tables 7-12.
- "No statistical difference was found (P<0.25) between the carrier and dilution water control length and weight data. The replicates of each test concentration were pooled and the pooled data were compared against the pooled data of both the carrier and dilution water controls.
- "The acceptability of the test (Ref 5) was determined from the relative standard deviation (RSD=100 times the standard deviation divided by the mean) of the weight of the fish which were alive at the end of the test in any control chamber.

"The values obtained for this study were 22.9 and 31.0% for the carrier control and 22.7 and 25.2% for the dilution water control and the data are therefore acceptable, being less than 40% (Ref 5). These data are shown in Table 12."

#### 13. Study Author's Conclusions/Quality Assurance Measures:

No significant effect was determined for larval survival or larval length. However, a significant effect was indicated for larval weight at 0.38  $\mu$ g/L (mean measured concentration) PP321. Therefore, the no-observable-effect level (NOEL) was determined to be 0.25  $\mu$ g/L and the lowest-observable-effect level (LOEL) was determined to be 0.38  $\mu$ g/L PP321.

The conduct of this study has been inspected/audited in accordance with ICI's policies and procedures for Good Laboratory Practice, as follows . . . .

## 14. Reviewer's Discussion and Interpretation of the Results:

- a. Test Procedures The following discrepancies were noted in the study:
  - The raw data were not submitted.
  - The SEP Guidelines (M. Rexrode and T. Armitage 1986), require a minimum of 20 embryos per replicate cup with 4 replicates per concentration (80 embryos total). This study only used 60 embryos per treatment level. The protocol attached to the study (submitted by ICI as well) recommended 80 embryos per treatment level. The study author (or company) should explain why their own protocol was not adhered to.
  - Since the raw data were not submitted, the statistical analysis cannot be completed. The data for each egg incubation cup are needed in order to conduct an ANOVA, and determine a NOEL.
  - According to Residue Analysis of Fish Diet (Table 5),
    Artemia salina and Promin, which were the feed sources
    for the test organisms, were contaminated with PCBs,
    with levels ranging from 30 to 51 ppb.
  - The study author should verify the precise embryonic stage at the beginning of the exposure. The embryos should have been 2 to 24 hours old at the beginning of the test. Twenty-four hours after being placed in the incubation cups, they should be counted and examined for dead or heavily fungused individuals, which should be discarded without disturbing the viable embryos.

The counting and examination should be repeated on a daily basis (M. Rexrode and T. Armitage 1986). Since the raw data were not submitted, this specific information was not available for review.

- The live fish should be counted (including lethargic and abnormal in either swimming behavior or physical appearance) 11, 18, 25, and 32 days after hatching. This information was not available for review.
- The study author indicated that the fish were fed until "Completion of the study." The fish should not be fed for at least 24 hours prior to termination on day 32. In addition, the amount of food should be the same for both the control and the treatment groups—otherwise, growth could not be a meaningful endpoint.
- The embryo cups should be made from glass jars with the bottoms replaced with 40-mesh stainless steel or nylon screen, not plastic tubing.
- The number of deformed was not reported. In addition, the study author did not report if abnormal behavior was indicated.
- The measured concentrations ranged from 20 to 64 percent at the nominal concentrations. The measured concentration of the test material in any chamber should be no more than 20 percent higher or 50 percent lower than the nominal concentration. See Attachment A for summary of analytical results.
- The study author did not indicate how many males or females were used to produce the embryos. The protocol submitted indicated eggs < 24 hours old from at least five females should be used. Since the study deviated from the protocol, i.e., number of eggs per egg incubation cup/treatment level, it is unclear if the study deviated from the submitted protocol with regards to this parameter as well.
- The photoperiod should have been 16L/8D, not 12 hours light/12 hours dark. The light intensity should have been 400 to 800 Lux instead of 2800 to 3300 Lux.
- b. Statistical Analysis Since the raw data were not submitted, the statistical analysis could not be verified.

The following should be included in the reported data:

- Number embryos hatched in each egg incubation cup;
- Time to hatch--for each egg incubation cup;

- Mortality of embryos, larvae, juveniles;
- Time to swim up; and
- Other effects such as deformities, abnormal behavior.

# c. Discussion of Results -

Since the raw data were not submitted, the discrepencies outlined in section 14 could not be clarified. There are specific concerns as outlined below:

- The light intensity and photoperiod vary considerably from the SEP guidelines for the fish early life stage testing.
- In addition, the reported NOEL for this study is approximately the same as the reported LC50 values for both the warmwater and colwater fish. This is unusual, and raises concern.
- The measured concentrations ranged from 20 to 64 percent of the nominal, instead of the recommended values of no more than 20 percent greater or 50 percent lower than the nominal concentrations.

# d. Adequacy of Study

- 1) Classification Supplemental -- 96.6% w/w.
- 2) Rationale Based on the major discrepancies outlined in section 14, this study is classified as supplemental.
- 3) Repairability If the raw data are submitted and clarify all the concerns outlined in section 14, the study may be reconsidered for reclassification.

Attachment

DATA ON HATCHABILITY AND SURVIVAL OF SHEEPSHEAD EMBRYOS AND LARVAE EXPOSED TO PP321

EXPO- SURE TANK	)- PP321*	NO OF EMBRYOS Al START	NÜMBER HATCHED	NUMBER OF FRY TCHED RELEASED	Z HATCH - NUMBER HATCHED×100 NO OF EMBRYOS**	Z HATCH - NUMBER RE- LEASEDX100 NO OF EMBRYOS	LARVAE NUMBER SURVIVING (28 days)	LARVAE % SURVIVAL FROM HATCH	LARVAE Z SURVIVAL FROM INITIAL	AVERAGE LENGTH # mm SD	AVERAGE WEIGHT # mg SD
2 A B	0.38	30	27 29	27 29	90.06	90.06	26 28	96.3 96.6	86.7 93.3	17.7 (2.1) 18.1 (1.2)	†154.8 (48.4) †161.0 (31.2)
4 A B	0.25	30	26 27	26 27	86.7 93.1	86.7 93.1	25 25	96.2 92.6	83.3	18.5 (1.5) 18.6 (1.2)	177.3 (39.1) 182.6 (37.4)
- - - -	0.14	32 30	26 29	26	81.3	81.3	25	96.2	78.1 90.0	18.5 (1.1) 17.7 (2.1)	172.4 (27.8) 163.3 (47.4)
م 8 .	0.07	29 29	24 25	24 25	82.8 86.2	82.8 86.2	22 24	91.7	75.9 82.8	18.6 (1.6) 18.5 (1.7)	190.5 (47.9) 186.1 (47.3)
S A B	) 0.04	30 31	30 29	30 29	100.0	100.0	28 28	93.3 96.6	93.3	18.7 (1.1) 17.6 (1.1)	184.4 (35.4) 163.3 (33.6)
3 A 8	) Carrier(DMF)30 ) control 29	(DMF)30 29	27	27 27	90.0 93.1	90.0	24 25	88.9 92.6	80.0 86.2	18.1 (2.4) 18.6 (1.6)	177.0 (54.9) 186.4 (42.7)
7 A B	) Diin water ) control	:er 30 31	28 26	28 26	93.3 83.9	93.3	26 26	92.9	86.7	18.4 (1.6) 18.3 (1.6)	176.1 (40.0) 168.0 (42.4)

<sup>\*</sup> Values are expressed as mean measured concentrations (ug/1) of PP321

Statistical data were calculated on \*\* the hatchability and \*\*\* overall survival from initial embryos.

. O t Values are alguifficantly (P<0.05) different from control values.

SD = standard deviation.



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#### Amendment to DER

#### Sheepshead Minnow Early Life Stage

The following are responses to the submitted data:

- The number of embryos (60) are significantly less than the recommended SEP guidelines (M. Rexrode and T. Armitage 1986). In addition, using the recommended protocols in Pesticide Assessment Guidelines Subdivision E, published in August 1982, the number of embryos should have been > 80 eggs per treatment level.

In this case, percent hatchability ranged from 81.3 to 100 percent. Therefore, it appears the fewer number of embryos per treatment did not affect the results of this study. The company should be informed that future studies submitted with 60 embryos per treatment are also suspect.

- The PCB levels of 51 ppb are within the acceptable limits drafted by ASTM (1983).
- The eggs were reported to have been approximately 27 hours old at test initiation. Since the eggs were < 48 hours old, EEB does not expect the exposure to embryos to have been significantly affected. Future studies submitted by the company should use embryos < 24 hours old to ensure the studies' scientific soundness.
- Since the company recorded daily if abnormalities or adverse behavioral symptoms were noticed, it appears that this observation parameter has been addressed.
- Since all fish were fed up until 12 hours prior to test termination, it appears the feeding would not affect the results of the weights between treatment groups.
- The practice of using plastic incubation cups is not recommended since this class of chemicals are known to absorb to substances such as plastic. There is also a concern for leaching as well. The company should not have used the Environmental Effects Guidelines Ref. EG 11, but referred to the protocols recommended in the 1982 Subdivision E Guidelines for fish early life stage testing. The USEPA National Quality Laboratory 1972 recommended glass incubation cups.

Since residue analysis was conducted at least every 7 days, and the concentrations remained within the same range, it appears this did not adversely affect the study. However, the company should be aware this is not a recommended practice and may affect the future studies if this procedure is continued.

- We are aware of the nature of this class of chemical and the difficulty in achieving a measured concentration to the nominal concentration. Since the concentrations within each treatment level seemed relatively consistent, this discrepancy is not expected to affect the study.
- The number of females (28) used to obtain the eggs are expected to produce enough spawnings to provide good variability. The number of males used are also expected to be satisfactory.
- The light intensity does raise concern, even when dividing by 2, as suggested by the author the reported lux ranged from 1400 to 1650. EEB is unaware of the photodegradation in water, and the light intensity may affect the chemical in such a way that the compound would break down and not be available to the test organism. However, since residue analysis was conducted, this is not expected to affect the scientific soundness of the studies.
- The statistical analysis using ANOVA and ANOVA Arc Sine was conducted on the following parameters:

(See attachments)

% survival of embryos = NOEL > 0.38 ug/L

% larval survival from hatch = NOEL > 0.38 ug/L

% larval survival from initial = NOEL > 0.38 ug/L

Length = NOEL > 0.38 ug/L

Weight = NOEL =  $\leq$  0.25 ug/L

= LOEL = 0.38 ug/L

These results indicate PP321 affects weight, a growth parameter at levels as low as 0.25 ug/L.

EEB categorizes this compound as very highly toxic to the sheepshead minnow.

- It appeared that the highest dose group had delayed hatching, but after conducting an ANOVA program it appeared that there was not a significant difference in time to hatch. The c.v. value was as high as 37.4, which indicates the statistical analysis was not as good since we prefer < 20.0 (see Attachment E).

### Discussion of Results

It appears that the discrepancies outlined earlier in the DER have been adequately addressed.

The company should be aware that the recommended protocols in Subdivision E 1982 should have been used.

The deviations in the methodology are not expected to have affected this study, but this may not be the case for future studies submitted by this company.

### Adequacy of Study

- 1. Classification Core 96% w/w.
- 2. The discrepancies have been adequately addressed.
- 3. Repairability N/A.

#### Discussion of Results

It appears that the discrepancies outlined earlier in the DER have been adequately addressed.

The company should be aware that the recommended protocols in Subdivision E 1982 should have been used.

The deviations in the methodology are not expected to have affected this study, but this may not be the case for future studies submitted by this company.

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- 3. Repairability N/A.

Candace Brassard

Ecological Effects Branch

Hazard Evaluation Division (TS-769-C)

Douglas J. Urban Head-Section III

Ecological Effects Branch

Hazard Evaluation Division (TS-769-C)

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313.			Α				•
314.		İ	B A	77.121	4	F	13. F
315.			в А				
316.			в а	76.687	4	Α	in the state of th
317.			в а				
318.			в а	73.624	4	.D	
319.			в а				
320.			B A	71.675	4	E	
321.	•	* - * * * * * * * * * * * * * * * * * *	В				
322.			В	66.856	4	С,	
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171.		COPYR	IGHT	(C) 1984,	1986 SAS	INST	ITUTE	INC.	, CAR	Y, N.	C. 2	7511,	U.S.	A.			ولا	ر "ن	7 N TO	1,7		n	)_# 	j.
245.				27511-800													$\mathcal{J}$	2 V)	) (C)		,	V	,	
? 1 245/1																		þ	- \ <u>`</u>			$\sim$		
245.		CARY,	N.C.	27511-800	00																	,		1
246.	1					٠.						SAS					12	:05 W	EDNES	DAY,	DECEM	BER 16,	1987	· .
247.																								
248.													R	R	R	R	R	R	R	R	R		R	
249				R	R	R	R	R	R	R	R	R	E	E	E	Ε	Ε	Е	Ε	Е	E	E	E	
250.				E	E	Ė	Е	E	E	Е	E	Ē	S	S	S	s	S	S	S	S	S	S	S	
251.		0	T	S	S	S	S	S	S	S	S	S	P	P	P	Þ	P	P	P	P	P	P	P	
252.		В	R	P	P	P	P	P	P	P	P	P	1	1	1	1	1	1	1	1	1	1	2 .	
253.		S	T	1 .	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	.8	9	0	
254. 255.		,	3	no ć	90.0																			
255. 256.		1 2	A B	92.6 96.6	88.9 93.3	•	•	•	•	•		•	•	•	•	•	•	•	•	٠	.•	•	•	
250. 257.		3	C	96.0	91.7	•	•	•	•	•	•	•		•	•	•	:•	•	•	•	•	•	•	
257. 258.		4	.D	93.1	96.2	•	•	•	•	. *	•	•	•	•	. •	•	•	•	•	•				
259.		5	E	92.6	96.2	•	•	•	•	•	•	•	•	•	•		•	•	•					
260.		6	F	96.6	96.3	•	•				•			• `		·			· ·					*
261.	1		-			-	-			•	•	SAS	-				12	:05 W	EDNES	DAY,	DECEM	BER 16	, 198	7
262.																								
263.									GENE	RAL I	LINEAF	R MODE	LS PR	OCEDU	URE									\$
264.																								
265.										CLAS	S LEVE	EL INF	ORMAI	ION							ě			
266.							*																	
267.									CLAS	SS	LEVE	ELS	VALU	JES										:
268.																								
269.									TRT		(	6	АВ	CDI	ΕF									. 1
270.																								1
271.												•												
272.								NUI	MBER C	OF OB	SERVA:	TIONS	IN DA	ATA S	ET = 1	20								
273.																								
274.																								
275.	NOTE:	ALL I	EPEND		BLES ARE							HE PRI	ESENCE	E OR	ABSENC	E OF	MISS	ING V	ALUES	. HOW	EVER,			
276.	_	ONLY	1	12 OBSERVA	TIONS CA	N BE	USED	IN T	HIS AN	VALYS	IS.						1.			ana.	DECE	wood 1	- 100	77
277.	1											SAS					1.	2:05 1	WEDNE	SUAY,	DECE	MBER 16	), 198	37
278.									CENT	TO B.	T TAIFER	n Mon	פור חו	n de con	N TOP									
279.									GENI	LKAL	LINEA	R MOD	ELS PI	ROCED	UKE									
280.	DEDEM	nciser i	лотае	01 C. CCCC	<b>~</b> ₽																			
281. 282.	DEPEN	DENT A	AKIAE	BLE: EFFEC	.1																			
283.	SOURC	<b>.</b>			DF	CIM	OF S	ישמגוור	c		MENN	SQUA	DE		F VAL	ाप्ट		PR	) F		R-SQ	HARF		C.V
284.	SOOKC	E.			DE	JUM	Or 3,	ZONICE			THEFT	- JQUA	IVL		r avm.	OL .					11 00	oracı		0.1
285.	MODEL				5		49.358	83405	Я		9.8	71668	12		1	23		0.3	989		0.50	5764		3.717
286.	PODED				,	-		03:103	•		3.0							0.0	, , ,					
287.	ERROR				6		48.23.	33678	4		8.0	38894	64					ROOT	MSE				EFFE	CT MEA
288.	Dia				ŭ		10	<b>.</b>	•			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	٠.						•					-
289.	CORRE	CTED 1	COTAL		11	9	97.59	17084	2								2.	83529	445				76.2	721217
290.							<b>,</b>	<b>-</b>	_															
291.			7.4															•						
292.	SOURC	E			DF		TYP	EIS	s	۴V	ALUE		PR >	F		DF		TYP	E II	I SS	F	VALUE	:	PR⇒
293.	** *	_																						
294.	TRT				5		49.35	83405	8		1.23		0.398	9		5		49.	. 3583	4058		1.23	3	0.398
295.	1											SAS					3	2:05	WEDN	ESDAY	, DECI	EMBER 1	6, 19	987
296.																					1			
297.									GEN	ERAL	LINE	AR MOD	ELS F	ROCE	DURE					/	19			
298.																				į	1			
299.	•					DUN	CAN'S	MULT	IPLE	RANG	E TEST	r for	VARIA	ABLE:	EFFEC	T								
200										4 PUDO 1	C 1911	יות מיי		MOND	TOOM	GD (0	naca i	ישראכ						

NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,

304.							
305 .	:	NUMBER OF MEANS	2	3	4	5	6
306.	•	CRITICAL RANGE	6.93782	7.19077	7.30814	7.36758	7.39479
307.							
308.		MEANS WITH THE	SAME LETT	er are not	SIGNIFICA	NTLY DIFFE	RENT.
309.	•						
310.		DUNCAN	GROUPING		MEAN	N TRT	Million All
311.							10 Dr. 3 126,
312.			A		79.110	2 F	
313.			A				
314.		e e	A		77.155	2 B	
315.			Α				
316.			A		76.734	2 D	
317.			A				
318.			A		76.456	2 E	
319.			A				
320.			. А		75.829	2 C	
321.			A				
322.			A		72.348	2 - A	

•										-						for the	M	L	ě		1		/	/
? fetch 79	78clr														ĺ	Jun	W ·	, de						()
7978CLR:																	UTV	- <b>M</b>			.1	. 1		7
? fetch 79															1		1 6	ノ	1		K		м	
? 1 'n/c.'															,	1			** X		1			
171. 245.	ONOTE:			(C) 1984, 27511-80		INST	TITUTE	INC.	, CAR	Y, N.	C. 2	7511,	U.S.A	۱,		1	• 1							
? 1 245/1																								
245.		CARY,	N.C.	27511-80	00																			
246.	1											SAS				,	12	:07 W	VEDNES	DAY,	DECEM	BER 16	5, 19	87
247																-	_	_	-	_		5		
248. 249.				R	R	R	R	R	R	R	R	R	R E	R E	R E	R E	R E	R E	R E	R E	R	R E	Ř E	
250.				E	E	E	E	E	E	E	E	E	S	S	S	S	S	S	s	S	s	S	S	
251.		0	T	s	s	s	s	s	s	s	s	s	P	P	P	P	P	P	P	P	P	Р	P	
252.		В	R	.P	P	P	P	P	P	P	P	P	1	1	1	1	1	1	. 1	1	1	1	2	
253.		S	T	1	2	.3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	
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255.		1	A	86.2	80.0	•	•	.•	.•	٠	•	•		•	٠	•	٠		•	•	•	•	•	
256. 257.		3	B C	90.3 82.8	93.3 75.9	•		•	٠	•		•	•	•	•	•	•	•	•	•	•	•	•	
258.		4	D	90.0	78.1	•	•	•	•		•	•		•		•	•	•		•	•		•	
259.		5	E	83.3	86.2						•						•			•		·		
260.		. 6	F	86.7	93.3					:•	.•													
261.	1											SAS					12	:07 1	WEDNE	SDAY,	DECEM	BER 1	6, 1	987
262.	-		٠																					
263.									GENE	ERAL L	INEA	R MODE	ELS PRO	OCEDUR	E	*								,
264. 265.										Ct Acc	• र स्टार्ग	27 7AT	م معروب	TON!										
266.										CIMOS	PEAL	TI TINE	FORMAT:	LON	*									
267.									CLAS	SS	LEVI	ELS	VALU	ES										
268.																								
269.									TRT			5	АВ	CDE	F									
270.																								
271.															_									
272. 273.								NUN	MBER (	OF OBS	SERVA'	rions	IN DA	TA SET	[ = ]	120					•			
273. 274.																								
275.	NOTE:	ALL D	EPEND	ENT VARIA	BLES ARE	CON	SISTEN	T WIT	TH RES	SPECT	то т	HE PRI	ESENCE	OR AE	SEN	CE OF	MISSI	ING V	ALUES	. HOW	VEVER,			
276.		ONLY	1	2 OBSERVA	TIONS CA	N BE	USED	IN T	HIS A	NALYS	IS.										·			
277.	1											SAS					12	2:07	WEDNE	SDAY	, DECE	MBER :	16, 1	.987
278.																								
279.									GEN	ERAL 1	LINEA	R MOD	ELS PR	OCEDUF	Œ									
280. 281.	, DEDEMI	DONER SE	ADTAD	io. Sesso	œ.																			
282.	DEFEIN	DETAIL AV	HICTHE	LE: EFFEC	1																		,	•
283.	SOURCE	Ε			DF	SUM	OF SC	OUARES	S		MEAN	SQUA	RE	F	VAL	UE		PR	> F		R-SQ	UARE		C.V
284.																								
285.	MODEL				5	1	50.901	13839	4		30.1	80276	79		1.	88		0.2	2312		0.61	.0982		5.887
286.																								
287.	ERROR				6	1	96.080	02153	7		16.0	13369	23				1	ROOT	MSE				EF	FECT ME
288.		-		-														001	7000				~~	000075
289.	CORRE	CTED TO	UľAL		11	2	46.98	15993	Ţ								4.	0016	/U80				ь/	.966075 <sup>ç</sup>
290. 291.																								
291. 292.	SOURCE	E			DF		TYPI	EIS	s	FV	ALUE		PR > F			DF		TY	PE II	I SS	F	. VALU	Ē	PR >
293.									-												_			
294.	TRT				5	1	50.90	13839	4		1.88		0.2312	2		5		150	.9013	8394		1.8	88	0.23
295.	l											SAS					1	2:07	WEDN	ESDAY	, DEC	EMBER	16,	1987
296.									, _											21				

GENERAL LINEAR MODELS PROCEDURE

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301.	NOT TH	E EXPERIMENTWISE ER	ROR RATE			
302	• *					
303.		ALPHA=0.05 DF=	6 MSE=16.0134	ļ.		-
304.						
305.	NUMBER OF MEAN	is 2	3 4	5	6	
306.	CRITICAL RANGE	9.79188 10.14	89 10.3145	10.3984	10.4368	
307.						
308.	MEANS WITH	THE SAME LETTER ARE	NOT SIGNIFICA	NTLY DIFFE	ERENT.	
309.						
310.	DUNCA	N GROUPING	MEAN	N TRT		
311.						
312.		A	73.396	2 B		
313.		Α			C/I	<b>.</b>
314.		A	71.776	2 F	, L	' Land
315.		A			$\mathcal{L}_{\mathcal{A}}$	JUN JUN!
316.		A	67.009	2 E	1 *	MILLEY !

66.804

65.787

63.023

2 D

2 A

2 C

317. 318.

319. 320.

321.

### HARMONIC MEAN OF CELL SIZES-50.8031

NUMBER OF MEANS 2 3 4 5 6 CRITICAL RANGE 0.635915 0.668704 0.689802 0.705652 0.718991

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	KEAN N	TRT
A 18.5	5674 46	Ċ
Α		
A 18.5	5280 50	Ε
Ä		
A 18.	3408 49	Α
A		
A 18.3	2321 56	В
Α		
A 18.1	1019 52	D
A		
A 17.4	9208 53	F

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JOS EDITING TIME

JOS, 52 PAGE WRITES

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JOS WYLBUR AT 1

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FF OBS WYLBUR AT 13:32:57 12/16/87 (87.350)

CONN MNS: 7.14 CPU SECS .13 DA I/O: 10 TERM I/O: 269
CONN: \$1.07 CPU: \$.09 EXCP: \$.36 \*TOTAL\*: \$1.52

SION

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VALID.

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CARY, N.C. 27511-8000

SAS 12:03 WEDNESDAY, DECEMBER 16, 198 R Ε Ε Ε Ε EEEEE Ε Ε Ε Ε Ε Ε Ε 0 T S S S S S BR 1 1 1 1 1 1 2 3 A 18.9 20.9 20.6 17.3 18.7 19.1 20.0 18.1 18.4 18.9 19.5 A 17.3 19.2 20.1 19.3 17.4 17.1 19.8 17.3 17.8 18.7 15.8 18.0 18.8 18.3 12.3 17.6 15.3 18.0 19.2 19.5 20.3 20.2 19.0 18.1 19.0 18.1 19.1 19.8 19.3 19.0 11.0 20.8 18.0 13.2 18.5 21.0 18.1 17.5 18.3 16.7 19.5 18.0 17.5 17.3 17.7 16.9 19.9 18.3 16.7 19.5 18.8 18.8 17.7 18.6 19.3 17.5 17.4 18.7 18.9 19.4 17.5 18.2 17.5 18.2 18.5 18.3 19.8 16.9

23

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10	E	10 1	10.0	19 7	19.4	19.1	19.1	17.8	19.6	19.1	19.4	1/./	17.4	14.5	18.0	10.7	10	.,*	•	•	•	
20	E	10 B	17 A	20.7	19.0	14.7	19.6	16.7	17.6	20.6	17.5	18.1	19./	•	•	•					•	
21	Ε	19.5	19.7	18.8	17.6	19.1	18.9	20.3	21.0	18.4	16.7	17.3	20.5	20.3	17.6	18.8	1/	•	•	•	•	
22	Ε	17.4													•							
23	F	17.9	18.0				•		•	•	•		•	•	•	•	•	•			•	
24	F	16.2	18.2	18.1	18.0	18.8	16.7	20.8	18.7	13.9	18.1	16.8	18.7		•	•	•			•	•	
25	F	19.7	18.7	20.2	17.9	16.8	18.5	19.5	15.8	18.4	17.6	16.8	16.9	12.0		•				•		
24	F	18.7	17.4	14.7	17.3	19.2	16.1	18.7	18.3	19.0	20.0	19.8	19.4	17.1	17.7	19.2	•		•	*		
27	F	19.7	18.3	18.5	17.6	16.3	17.6	14.4	19.0	19.4	18.5	20.2				•			•	•		
	,									SAS				12	:03 WE	DNESDA	¥Υ,	DEC	EMBI	ΞR	16,	198

# GENERAL LINEAR MODELS PROCEDURE

CLASS LEVEL INFORMATION

CLASS LEVELS VALUES

TRT 6 ABCDEF

# NUMBER OF OBSERVATIONS IN DATA SET = 540

NOTE: ALL DEPENDENT VARIABLES ARE CONSISTENT WITH RESPECT TO THE PRESENCE OR ABSENCE OF MISSING VALUES. HOWEVER, ONLY 306 OBSERVATIONS CAN BE USED IN THIS ANALYSIS.

SAS

12:03 WEDNESDAY, DECEMBER 16, 198

# GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RESP

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE
MODEL	5	15.65451422	3.13090284	1.20	0.3077	0.019653
ERROR	300	7 <b>80.879</b> 37 <b>466</b>	2.60293125		ROOT MSE	RES
CORRECTED TOTAL	30 <b>5</b>	796.53388889			1.61336024	18.27
SDURCE	DF	TYPE I SS	F VALUE PR > F	: DF	TYPE III SS	F VALUE
TRT	5	15.65451422	1.20 0.3077	7 5	15.65451422	1.20
			SAS		12:03 WEDNESDA	, DECEMBER 16, 198

# GENERAL LINEAR MODELS PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESP NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE

ALPHA=0.05 DF=300 MSE=2.60293

24

# GENERAL LINEAR MODELS PROCEDURE

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESP NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE

ALPHA=0.05 DF=282 MSE=1767.31

WARNING: CELL SIZES ARE NOT EQUAL.

HARMONIC MEAN OF CELL SIZES=47.4502

NUMBER OF MEANS 2 3 4 5 6 CRITICAL RANGE 17.1455 18.0295 18.5984 19.0257 19.3853

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN	GROUPING	MEAN	N	TRT
	À	186.071	45	C
	A	181.782	49	A
E	A.	175.780	44	Ε
E		173.895	55	В
· E		170.615	41	Ď
E	}	157.991	54	F
	•	14/ : 171	UT	i.

HXX AW FETCH

) clr

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CARY, N.C. 27511-8000

HKY,	N. L	. Z/31	1-8000	,						SAS				12	:03 WEI	DNESDAY	, D	ECE	MBE	R 1	6, 1	98
											R	R	R	R	R	R	R	R	R	R	R	
		R	R	R	R	R	R	R	Ŕ	R	Ε	Ε	E	E	Ε	Ε	Έ	Ε	Ε	Ε	Ε	
	. •	Ε	Ε	Ε	E	Ε	Ε	Ε	E	Ε	S	S	S	S	S	S	S	S	S	S	S	
0	Ţ	S	S	S	S	S	S	S	S	S	P	P	P	P	P	Ρ	P	Ρ	P	P	P	
В	R	P	F	P	P	P	P	P	P	P	i	1	1	1	1	1	1	1	1	1	2	
S	T	1	2	3	4	5	6	7	8	9	0	1	2	3 .	4	5	6	7	8	9	0	
	Α	18.9	20.9	20.4	177	10 7	10 1	20.0	10 1	, 10 A	10 0	10 5	10 0									
3			19.2	20.1			19.1 17.1	19.8	17.3		18.9 18.7		18.0	•	•	•	.•	,•	•	•	•	
- <u>- ∠</u> - ₹	A	18.8	18.3		17.6		18.0	17.0	17.5		20.2		18.1	•	•	•	•	•	•	•	•	
ر. 1	A	19.0	18.1	19.1	19.8		19.0	11.0	20.8	18.0		18.5		18.1	•	•	•	•	•	•	•	
5	В	17.7	17.5	18.3	16.7	19.5	18.0	17.5	17.3	16.9	19.9		16.7	18.6	19.1	•	•	•	•	•	•	
4	В	19.4	18.4	19.5	18.8	18.8	17.7	18.6			17.4			10.0	1711	•	•		•	•	•	
7	B	19.8	15.8	19.8	17.5		17.5	18.2	18.5	18.3	16.9			•	•	•	•	•	•	•	•	
8	В	20.6	18.3		16.6		19.2				15.7	19.7	15.7	•	•	•	•	•	•	•	•	
9	В	17.6	17.4	17.5	18.7	19.5	17.3	16.6	19.0						•	·	•	•			•	
10	C	17.7	21.3	18.4	14.7	18.1			19.9		18.0	18.4	19.1									L
11	C	19.6	19.5	19.0	15.5	19.8	18.8	18.4	18.7	19.1	19.9	16.4										
12	C	18.6	19.0	18.9	18.9	19.8	17.8	19.0		18.7	19.1			19.2								
13	С	17.9	12.6	17.3	18.5	16.4	19.3	19.4	17.2	20.4	•											
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16, 1987 231.	1														(	magai <sup>a</sup>		W	M	6.	7 ()		
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243.		5 6	E	13	8	12	12	•	•	•		•	•	•	•	•	•	•	•	•	•	•	
244. 245.	1	6	F	4	1	14	14	•	٠	.•	 S7		•	•	•		5:17	WEDNI	SDAY,	DECEN	MBER 16	5. 198	7
245. · 246.	Ł														,							',	,
247.									GENE	ERAL LI	NEAR I	ODELS	PROCE	DURE									
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250. 251									יע זע.	~~	m rest (c	. 1/7	TTEC										
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252. 253.									TRT		6	A	ВСД	EF									
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257.																							
258.	NOTE:	ATT. DEL	>FMDEN	rr VART	ARI.ES	ARE C	ONSTST	זאר WT	TH RES	SPECT 1	ካ THE	PRESEI	ICE OF	ABSE	NCE O	F MIS	SING	VALUE	s HOV	WEVER,			
258. 259.	NOTE:	ALL DEI		NT VARI OBSERV								PRESE	NCE OF	ABSE	NCE O	F MIS	SING !	VALUE	s. HOV	WEVER,			
258.	NOTE:										5.	PRESEI	VCE OF	ABSE	INCE O						MBER 10	6, 198	37
258. 259. 260.									HIS A	NALYSIS	5. S	<i>l</i> s			INCE C						MBER 10	6, 198	37
258. 259. 260. 261. 262. 263.									HIS A		5. S	<b>A</b> S			INCE O						MBER 10	6, 198	37
258. 259. 260. 261. 262. 263. 264.	1	ONLY	24	OBSERV	/ATIONS				HIS A	NALYSIS	5. S	<b>A</b> S			INCE O						MBER 10		
258. 259. 260. 261. 262. 263. 264.	1		24	OBSERV	/ATIONS				HIS A	NALYSIS	5. S	<b>A</b> S			INCE O						MBER 1		
258. 259. 260. 261. 262. 263. 264. 265. 266.	DEPEN	ONLY IDENT VAI	24	OBSERV	/ATIONS	s can i	BE USEI	D IN T	THIS AN	NALYSIS	5. S	AS MODELS					15:17			, DECE	MBER 10		20 <sup>%</sup> c.v
258. 259. 260. 261. 262. 263. 264.	1	ONLY IDENT VAI	24	OBSERV	VATIONS	s can i		D IN T	THIS AN	NALYSIS	S. S.	AS MODELS		DURE:			15:17	WEDN		, DECE			20%
258. 259. 260. 261. 262. 263. 264. 265. 266.	DEPEN	ONLY IDENT VAI	24	OBSERV	VATIONS	s can i	BE USEI	D IN T	HIS ANGEN	NALYSIS	S. S.	AS MODELS QUARE		EDURE FVA			15:17 PR	WEDN		, DECE		7.	20%
258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270.	DEPEN SOURCE MODEL	ONLY  IDENT VAI	24	OBSERV	DF 5	s can i	BE USEI	SQUARE	GENI	NALYSIS	S.  S.  NEAR:  MEAN S.  4.441	AS MODELS QUARE 66667		EDURE FVA	ALUE		15:17 PR 0.	WEDN		, DECE	)UARE	7.	20 <sup>9/1</sup> C.V 37.442
258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270.	DEPEN SOURCE	ONLY  IDENT VAI	24	OBSERV	PATIONS DF	s can i	BE USEI	D IN T	GENI	NALYSIS	S. NEAR :	AS MODELS QUARE 66667		EDURE FVA	ALUE		15:17 PR 0.	wedn		, DECE	)UARE	7.	20% c.v
258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271.	DEPEN SOURC MODEL ERROR	ONLY  JUENT VAL	24 RIABLE	OBSERV	DF 5 18	s can i	SUM OF 1 22.20	SQUARE 083333	GENI	NALYSIS	S.  S.  NEAR:  MEAN S.  4.441	AS MODELS QUARE 66667		EDURE FVA	ALUE	-	PR 0. ROOT	WEDN	ESDAY (	, DECE	)UARE	7.	20 <sup>%</sup> t C.V 37.442 SP MEA
258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272.	DEPEN SOURC MODEL ERROR	ONLY  IDENT VAI	24 RIABLE	OBSERV	DF 5	s can i	SUM OF 1 22.20	SQUARE	GENI	NALYSIS	S.  S.  NEAR:  MEAN S.  4.441	AS MODELS QUARE 66667		EDURE FVA	ALUE	-	PR 0. ROOT	WEDN	ESDAY (	, DECE	)UARE	7.	20 <sup>9/1</sup> C.V 37.442
258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271.	DEPEN SOURC MODEL ERROR	ONLY  JUENT VAL	24 RIABLE	OBSERV	DF 5 18	s can i	SUM OF 1 22.20	SQUARE 083333	GENI	NALYSIS	S.  S.  NEAR:  MEAN S.  4.441	AS MODELS QUARE 66667		EDURE FVA	ALUE	-	PR 0. ROOT	WEDN	ESDAY (	, DECE	)UARE	7.	20 <sup>%</sup> t C.V 37.442 SP MEA
258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273.	DEPEN SOURC MODEL ERROR	ONLY DENT VAI	24 RIABLE	OBSERV	DF 5 18	s can i	SUM OF 1 22.20 229.70 251.9	SQUARE 083333	GENI GENI ES 33 00	NALYSIS	S. S	AS MODELS QUARE 66667 88889		EDURE FVA	ALUE	-	PR 0. ROOT	WEDN  R > F  8768  R MSE	ESDAY (	R-SQ	)UARE	RE: 9.5	20 <sup>%</sup> t C.V 37.442 SP MEA
258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277.	DEPEN SOURCE MODEL ERROR CORRE	ONLY DENT VAI	24 RIABLE	OBSERV	DF 18 23 DF	s can i	SUM OF \$ 22.20 229.70 251.9	SQUARE 083333 500000 583333	GENI GENI 33 33 55	NALYSIS ERAL LI	ENEAR : 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	AS AODELS QUARE 66667 888889 PR	PROCE	EDURE FVA	DF	-	PR 0. ROOT	WEDN  8 > F  8768  7 MSE  55852	ESDAY,	R-SQ	OUARE 88143 7 VALUE	RE: 9.5	20% C.V 37.442 SP MEA 416666
258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 270. 271. 272. 273. 274. 275. 276. 277. 278.	DEPEN SOURCE ERROR CORRESOURCE TRT	ONLY DENT VAI	24 RIABLE	OBSERV	DF 5 18 23	s can i	SUM OF \$ 22.20 229.70 251.9	SQUARE 083333 500000	GENI GENI 33 33 55	NALYSIS ERAL LI	S. S	AS 40DELS 2UARE 66667 88889 PR 0.8	PROCE	EDURE FVA	LUE ).35	3	PR 0. ROOT TY 22	WEDN  R > F  8768  "MSE  55852  VPE II	ESDAY,	R-SQ 0.08	OUARE 88143 F VALUE 0.35	RE: 9.5	20%t C.V 37.442 SP MEA 416666 PR >
258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 270. 271. 272. 273. 274. 275. 276. 277. 278.	DEPEN SOURCE MODEL ERROR CORRE	ONLY DENT VAI	24 RIABLE	OBSERV	DF 18 23 DF	s can i	SUM OF \$ 22.20 229.70 251.9	SQUARE 083333 500000 583333	GENI GENI 33 33 55	NALYSIS ERAL LI	S. S	AS AODELS QUARE 66667 888889 PR	PROCE	EDURE FVA	DF	3	PR 0. ROOT TY 22	WEDN  R > F  8768  "MSE  55852  VPE II	ESDAY,	R-SQ 0.08	OUARE 88143 7 VALUE	RE: 9.5	20%t C.V 37.442 SP MEA 416666 PR >
258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280.	DEPEN SOURCE ERROR CORRESOURCE TRT	ONLY DENT VAI	24 RIABLE	OBSERV	DF 18 23 DF	s can i	SUM OF \$ 22.20 229.70 251.9	SQUARE 083333 500000 583333	GENI GENI GENI GENI GENI GENI GENI GENI	NALYSIS ERAL LI	S.	AS MODELS QUARE 66667 88889 PR 0.8	PROCE > F 768	EDURE F VA	DF	3	PR 0. ROOT TY 22	WEDN  R > F  8768  "MSE  55852  VPE II	ESDAY,	R-SQ 0.08	OUARE 88143 F VALUE 0.35	RE: 9.5	20%t C.V 37.442 SP MEA 416666 PR >
258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 270. 271. 272. 273. 274. 275. 276. 277. 278.	DEPEN SOURCE ERROR CORRESOURCE TRT	ONLY DENT VAI	24 RIABLE	OBSERV	DF 18 23 DF	s can i	SUM OF \$ 22.20 229.70 251.9	SQUARE 083333 500000 583333	GENI GENI GENI GENI GENI GENI GENI GENI	NALYSIS ERAL LI	S.	AS MODELS QUARE 66667 88889 PR 0.8	PROCE > F 768	EDURE F VA	DF	3	PR 0. ROOT TY 22	WEDN  R > F  8768  "MSE  55852  VPE II	ESDAY,	R-SQ 0.08	OUARE 88143 F VALUE 0.35	RE: 9.5	20%t C.V 37.442 SP MEA 416666 PR >
258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281.	DEPEN SOURCE ERROR CORRESOURCE TRT	ONLY DENT VAI	24 RIABLE	OBSERV	DF 18 23 DF	S CAN	SUM OF \$ 22.20 229.70 251.9	SQUARE 083333 500000 583333 PE I S	GENI GENI GENI GENI GENI GENI GENI GENI	NALYSIS ERAL LI F VA O	S. S	AS AODELS QUARE 66667 888889 PR 0.8 AS	PROCE	EDURE	DF	3	PR 0. ROOT TY 22	WEDN  R > F  8768  "MSE  55852  VPE II	ESDAY,	R-SQ 0.08	OUARE 88143 F VALUE 0.35	RE: 9.5	20%t C.V 37.442 SP MEA 416666 PR >
258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282.	DEPEN SOURCE ERROR CORRESOURCE TRT	ONLY DENT VAI	24 RIABLE	OBSERV	DF 18 23 DF	S CAN	SUM OF : 22.20.251.9	SQUARE 083333 5000000 583333 FPE I S	GENI GENI GENI GENI GENI GENI GENI GENI	NALYSIS ERAL LI F VA O NERAL L RANGE	EAN S 4.441 12.763 LUE .35 S INEAR	AS AODELS QUARE 66667 888889 PR 0.8 AS MODELS	PROCE	EDURE  EDURE  : RESI	DF 5	3	PR 0. ROOT TY 22 15:17	WEDN 8 > F 8768 1 MSE 155852 2.2083 7 WEDN	ESDAY,	R-SQ 0.08	OUARE 88143 F VALUE 0.35	RE: 9.5	20%t C.V 37.442 SP MEA 416666 PR >
258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285.	DEPEN SOURCE ERROR CORRESOURCE TRT	ONLY DENT VAI	24 RIABLE	OBSERV	DF 18 23 DF	S CAN	BE USEI  SUM OF 1  22.20  229.70  251.9  TY  22.2	SQUARE 083333 500000 583333 PE I S	GENI GENI GENI GENI GENI GENI GENI GENI	NALYSIS ERAL LI F VA O NERAL L RANGE	ENEAR : SEAN SEAN SEAN SEAN SEAN SEAN SEAN SEAN	AS  AODELS  QUARE  66667  88889  PR  0.8  AS  MODELS  OR VAF  YPE I	PROCE 768 PROCE RIABLE COMPA	EDURE  EDURE  : RESI	DF 5	3	PR 0. ROOT TY 22 15:17	WEDN 8 > F 8768 1 MSE 155852 2.2083 7 WEDN	ESDAY,	R-SQ 0.08	OUARE 88143 F VALUE 0.35	RE: 9.5	20%t C.V 37.442 SP MEA 416666 PR >
258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286.	DEPEN SOURCE ERROR CORRESOURCE TRT	ONLY DENT VAI	24 RIABLE	OBSERV	DF 18 23 DF	S CAN	BE USEI  SUM OF 1  22.20  229.70  251.9  TY  22.2	SQUARE 083333 500000 583333 PE I S	GENI GENI GENI GENI GENI GENI GENI GENI	F VA  O  NERAL L  RANGE  ONTROLS  ERIMENT	EAN S 4.441 12.763 LUE .35 SINEAR THE	AS  MODELS  QUARE  66667  88889  PR  0.8  AS  MODELS  OR VAR  YPE I  ERROR F	PROCE	F VA	DF 5	3	PR 0. ROOT TY 22 15:17	WEDN 8 > F 8768 1 MSE 155852 2.2083 7 WEDN	ESDAY,	R-SQ 0.08	OUARE 88143 F VALUE 0.35	RE: 9.5	20%t C.V 37.442 SP MEA 416666 PR >
258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286. 287.	DEPEN SOURCE ERROR CORRESOURCE TRT	ONLY DENT VAI	24 RIABLE	OBSERV	DF 18 23 DF	S CAN	BE USEI  SUM OF 1  22.20  229.70  251.9  TY  22.2	SQUARE 083333 500000 583333 PE I S	GENI GENI GENI GENI GENI GENI GENI GENI	NALYSIS ERAL LI F VA O NERAL L RANGE CNIROLS	EAN S 4.441 12.763 LUE .35 SINEAR THE	AS  MODELS  QUARE  66667  88889  PR  0.8  AS  MODELS  OR VAR  YPE I  ERROR F	PROCE	F VA	DF 5	3	PR 0. ROOT TY 22 15:17	WEDN 8 > F 8768 1 MSE 155852 2.2083 7 WEDN	ESDAY,	R-SQ 0.08	OUARE 88143 F VALUE 0.35	RE: 9.5	20%t C.V 37.442 SP MEA 416666 PR >
258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286.	DEPEN SOURCE ERROR CORRESOURCE TRT	ONLY DENT VAI	24 RIABLE	OBSERV	DF 18 23 DF	S CAN	BE USEI  SUM OF 1  22.20  229.70  251.9  TY  22.2	SQUARE 083333 500000 583333 PE I S 2083333	GENI GENI GENI GENI GENI GENI GENI GENI	F VA  O  NERAL L  RANGE  ONTROLS  ERIMENT	EAN S 4.441 12.763 LUE .35 SINEAR THE	AS  MODELS  QUARE  66667  88889  PR  0.8  AS  MODELS  OR VAR  YPE I  ERROR F	PROCE	F VA	DF 5	3	PR 0. ROOT TY 22 15:17	WEDN 8 > F 8768 1 MSE 155852 2.2083 7 WEDN	ESDAY,	R-SQ 0.08	OUARE 88143 F VALUE 0.35	RE: 9.5	20%t C.V 37.442 SP MEA 416666 PR >

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295.	•					
296.			A	11.250	4	E
297.			A			
298.			A	10.250	4	A
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306.			A	8.250	4	F

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231	**	****	***************************************							1		S CANADA	4	300					H	r U	"U		
232.												R	R	R	R	R	R	R.	R	R	R 1	R	
233.				R	R	R	R	R	R	R	R R		E	E	E	Ë	E	B	E	E		E	
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247. 248.									GENE	KAL I	INCAK I	MODELS I	MULL	JUKE									
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254. 255.	<del>-</del> ,																						
256.								N	UMBER (	OF OBS	SERVATI	ONS IN	DATA	SET =	120								
257.				*																			
258.											·	-	·			nja seri	MC1723	17% T TT	ee° no	eagin sions			
259. 260.	NOTE: ALL ONLY											PRESEN	UK UR	C ABSE	ا کلنه	OF MIL	PATTOC	AUTOR	۰. π∪	TEVEK,	,		
			74 4	ORCEON	<b>የ</b> ፈጥፐጥል፣	SCAN	BE LICE	M	IHI> *	MM1.4-	IS.												
	1	2	24 (	OBSERV	ATION	S CAN	BE USE	י אז ח	IHIS W	WAT 12		AS					15:17	WEDI	VESDAY	, Deci	EMBER	16, 198	37
261. 262.		Ľ	24 (	OBSERV	ATION	S CAN	be use	י אז ט	IHT2 W	NALIS		SAS					15:17	WEDN	VESDAY	, DECI	EMBER	16, 198	37
261.		•	24 (	OBSERV	ATION	s Can	BE USE	D IN			.5	MODELS	PROCE	EDURE			15:17	WEDN	VESDAY	, DECI	EMBER	16, 198	37
261. 262.			24 (	OBSERV	/ATION	s Can	BE USE	D IN			.5		PROCE	DURE			15:17	WEDN	VESDAY	, Deci	EMBER		<b>A</b> .(
261. 262. 263. 264. 265.						s Can	BE USE	D IN			.5		PROCE	EDURE			15:17	7 WEDN	Vesday	, DECI	EMBER		20 <sup>9/c</sup>
261. 262. 263. 264. 265. 266.	1 DEPENDENT				•				GEN		.5	MODELS	PROCE	EDURE F V	ALUE			/ WEDN		*	EMBER QUARE		<b>A</b> .(
261. 262. 263. 264. 265.	1						be use		GEN		S LINEAR	MODELS	PROCE		ALLUE ALLUE					*			20 <sup>%</sup> c
261. 262. 263. 264. 265. 266.	1 DEPENDENT				•		SUM OF		gen Es		e Linear Mean s	MODELS	PROCE	F VZ	ALUE		Pl			R-S		7.	20 <sup>%</sup> c
261. 262. 263. 264. 265. 266. 267. 268. 269.	DEPENDENT SOURCE MODEL				DF 5		SUM_OF 22.2	SQUAR 208333	GEN ES 33		ELINEAR MEAN S 4.44	MODELS SQUARE	PROCE	F VZ			PI O	R > F		R-S	QUARE	7.	20 <sup>9/c</sup> c.v
261. 262. 263. 264. 265. 266. 267. 268. 269. 270.	DEPENDENT SOURCE				DF		SUM_OF 22.2	SQUAR	GEN ES 33		e Linear Mean s	MODELS SQUARE	PROCE	F VZ		•	PI O	R > F		R-S	QUARE	7.	20 <sup>%</sup> c
261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271.	DEPENDENT SOURCE MODEL ERROR	VAR	IABLE		DF 5		22.2 229.7	<b>SQUAR</b> 208333 750000	GEN ES 33		ELINEAR MEAN S 4.44	MODELS SQUARE	PROCE	F VZ			PI O ROO	R > F .8768 T MSE		R-S	QUARE	7 ·	20 <sup>9/c</sup> c.v
261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272.	DEPENDENT SOURCE MODEL	VAR	IABLE		DF 5		22.2 229.7	SQUAR 208333	GEN ES 33		ELINEAR MEAN S 4.44	MODELS SQUARE	PROCE	F VZ			PI O	R > F .8768 T MSE		R-S	QUARE	7 ·	20 <sup>9/c</sup> c.v 37.442 SP MEA
261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271.	DEPENDENT SOURCE MODEL ERROR	VAR	IABLE		DF 5		22.2 229.7	<b>SQUAR</b> 208333 750000	GEN ES 33		ELINEAR MEAN S 4.44	MODELS SQUARE	PROCE	F VZ			PI O ROO	R > F .8768 T MSE		R-S	QUARE 88143	RE 9.5	20 <sup>%</sup> c C.V 37.442 SP MEA 416666
261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274.	DEPENDENT SOURCE MODEL ERROR	VAR	IABLE		DF 5		22.2 229.7 251.9	<b>SQUAR</b> 208333 750000	GEN ES 33 000	ERAL	ELINEAR MEAN S 4.44	MODELS SQUARE		F VZ			PI 0 ROO 3.572	R > F .8768 T MSE 65852		R-S	QUARE	RE 9.5	20 <sup>9/c</sup> c.v 37.442 SP MEA
261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277.	DEPENDENT SOURCE MODEL ERROR CORRECTED	VAR	IABLE		DF 5 18 23 DF		22.2 229.7 251.9	SQUAR 208333 750000 958333 YPE I	GEN ES 33 000	F V	LINEAR  MEAN S  4.441  12.763	MODELS SQUARE 166667 3888889	F	F VZ	DF		PI 0 ROO 3.572 T	.8768 T MSE 65852	II SS	R-S	QUARE 88143 F VALU	RE 9.5	20%c C.V 37.442 SP MEA 416666
261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278.	DEPENDENT SOURCE MODEL ERROR CORRECTED SOURCE	VAR	IABLE		DF 5 18 23		22.2 229.7 251.9	<b>SQUAR</b> 208333 750000 958333	GEN ES 33 000	F V	LINEAR  MEAN S  4.441  12.763	MODELS  SQUARE  166667  388889  PR :  0.8	F	F VZ	0.35		PI 0 ROO 3.572 T	R > F .8768 T MSE 65852 YPE I 2.208	II SS 333333	R-S	QUARE 88143 F VALU	RE 9.5	20%c C.V 37.442 SP MEA 416666 PR >
261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279.	DEPENDENT SOURCE MODEL ERROR CORRECTED	VAR	IABLE		DF 5 18 23 DF		22.2 229.7 251.9	SQUAR 208333 750000 958333 YPE I	GEN ES 33 000	F V	LINEAR  MEAN S  4.441  12.763	MODELS SQUARE 166667 3888889	F	F VZ	DF		PI 0 ROO 3.572 T	R > F .8768 T MSE 65852 YPE I 2.208	II SS 333333	R-S	QUARE 88143 F VALU	RE 9.5	20%c C.V 37.442 SP MEA 416666 PR >
261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280.	DEPENDENT SOURCE MODEL ERROR CORRECTED SOURCE	VAR	IABLE		DF 5 18 23 DF		22.2 229.7 251.9	SQUAR 208333 750000 958333 YPE I	GEN ES 33 000 333 SS	F V	LINEAR  MEAN S  4.441  12.763  VALUE  0.35	MODELS  SQUARE  166667  388889  PR :  0.8	> F	F VA	DF 5		PI 0 ROO 3.572 T	R > F .8768 T MSE 65852 YPE I 2.208	II SS 333333	R-S	QUARE 88143 F VALU	RE 9.5	20%c C.V 37.442 SP MEA 416666 PR >
261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280.	DEPENDENT SOURCE MODEL ERROR CORRECTED SOURCE	VAR	IABLE		DF 5 18 23 DF		22.2 229.7 251.9	SQUAR 208333 750000 958333 YPE I	GEN ES 33 000 333 SS	F V	LINEAR  MEAN S  4.441  12.763  VALUE  0.35	MODELS SQUARE L66667 B88889 PR : 0.8	> F	F VA	DF 5		PI 0 ROO 3.572 T	R > F .8768 T MSE 65852 YPE I 2.208	II SS 333333	R-S	QUARE 88143 F VALU	RE 9.5	20%c C.V 37.442 SP MEA 416666 PR >
261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280.	DEPENDENT SOURCE MODEL ERROR CORRECTED SOURCE	VAR	IABLE		DF 5 18 23 DF	£	22.2 229.7 251.9 T7	SQUAR 208333 750000 958333 YPE I 208333	GEN ES 33 000 33 SS 333 GEN	F V	MEAN S 4.441 12.763  VALUE 0.35  LINEAR	MODELS  SQUARE  166667  388889  PR:  0.8'  SAS  MODELS	F 768 PROC	F VA	DF 5		PI 0 ROO 3.572 T 2 15:1	R > F .8768 T MSE 65852 YPE I 2.208 7 WED	II SS 333333	R-S	QUARE 88143 F VALU	RE 9.5	20%c C.V 37.442 SP MEA 416666 PR >
261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281.	DEPENDENT SOURCE MODEL ERROR CORRECTED SOURCE	VAR	IABLE		DF 5 18 23 DF	£	22.2 229.7 251.9 T: 22.3	SQUAR 208333 750000 958333 YPE I 208333	GEN ES 33 000 333 SS 333 GEN LTIPLE	F \	MEAN S 4.441 12.763  ALUE 0.35  LINEAR E TEST LIS THE	MODELS  EQUARE  166667  388889  PR  0.8  SAS  MODELS  FOR VAR  TYPE I	F F 768 PROC LIABLE COMPA	F VA	DF 5		PI 0 ROO 3.572 T 2 15:1	R > F .8768 T MSE 65852 YPE I 2.208 7 WED	II SS 333333	R-S	QUARE 88143 F VALU	RE 9.5	20%c C.V 37.442 SP MEA 416666 PR >
261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283.	DEPENDENT SOURCE MODEL ERROR CORRECTED SOURCE	VAR	IABLE		DF 5 18 23 DF	£	22.2 229.7 251.9 T: 22.3	SQUAR 208333 750000 958333 YPE I 208333	GEN ES 33 000 333 SS 333 GEN LTIPLE	F \	MEAN S 4.441 12.763  ALUE 0.35  LINEAR E TEST LIS THE	MODELS  SQUARE  166667  388889  PR:  0.8'  SAS  MODELS	F F 768 PROC LIABLE COMPA	F VA	DF 5		PI 0 ROO 3.572 T 2 15:1	R > F .8768 T MSE 65852 YPE I 2.208 7 WED	II SS 333333	R-S	QUARE 88143 F VALU	RE 9.5	20%c C.V 37.442 SP MEA 416666 PR >
261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286.	DEPENDENT SOURCE MODEL ERROR CORRECTED SOURCE	VAR	IABLE		DF 5 18 23 DF	£	22.2 229.7 251.9 T: 22.3	SQUAR 208333 750000 958333 YPE I 208333	GEN ES 33 000 333 SS GEN LTIPLE ITEST CO	F V	LINEAR  MEAN S  4.441  12.763  VALUE  0.35  LINEAR  2 TEST LIS THE NYWISE	MODELS  SQUARE  166667  388889  PR  0.8  SAS  MODELS  FOR VAR  TYPE I	F F F F F F F F F F F F F F F F F F F	F VA	DF 5		PI 0 ROO 3.572 T 2 15:1	R > F .8768 T MSE 65852 YPE I 2.208 7 WED	II SS 333333	R-S	QUARE 88143 F VALU	RE 9.5	20%c C.V 37.442 SP MEA 416666 PR >
261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286. 287.	DEPENDENT SOURCE MODEL ERROR CORRECTED SOURCE	VAR	IABLE		DF 5 18 23 DF	£	22.2 229.7 251.9 T: 22.3	SQUAR 208333 750000 958333 YPE I 208333	GEN ES 33 000 333 SS GEN LTIPLE ITEST CO	F V	LINEAR  MEAN S  4.441  12.763  VALUE  0.35  LINEAR  2 TEST LIS THE NYWISE	MODELS  EQUARE  166667  388889  PR  0.8  SAS  MODELS  FOR VAR  TYPE I	F F F F F F F F F F F F F F F F F F F	F VA	DF 5		PI 0 ROO 3.572 T 2 15:1	R > F .8768 T MSE 65852 YPE I 2.208 7 WED	II SS 333333	R-S	QUARE 88143 F VALU	RE 9.5	20%c C.V 37.442 SP MEA 416666 PR >
261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286.	DEPENDENT SOURCE MODEL ERROR CORRECTED SOURCE	VAR	IABLE		DF 5 18 23 DF	<b>£</b>	22.2 229.7 251.9 T: 22.3	SQUAR 208333 750000 958333 YPE I 208333 'S MUI THIS 'S	GEN  ES  33  00  333  SS  CEP  LTIPLE TEST COHE EXP	F V NERAL RANGE CNTRO CERIME	LINEAR  MEAN S  4.441  12.763  VALUE  0.35  LINEAR  2 TEST LIS THE NYWISE	MODELS  SQUARE  166667  388889  PR  0.8  SAS  MODELS  FOR VAR  TYPE I	F F F F F F F F F F F F F F F F F F F	F VA	DF 5		PI 0 ROO 3.572 T 2 15:1	R > F .8768 T MSE 65852 YPE I 2.208 7 WED	II SS 333333	R-S	QUARE 88143 F VALU	RE 9.5	20%c C.V 37.442 SP MEA 416666 PR >

293.				
294.	DUNCAN GROUPING	MEAN	N	TRT
295.				
296.	A	11.250	4	Е
297.	• А			
298.	A	10.250	4	A
299.	А			
300.	A	9.250	4	С
301.	Ä			
302.	, A	9.250	4	D
303.	'A			
304.	А	9.000	4	В
305.	. <b>A</b>			
306.	, <b>A</b>	8.250	4	F