

STA 4211 – Spring 2004 – Take Home Project 2 – Due 2/23/04

Print Name:

UFID:

A painter wishes to compare the effects of three brands of acrylic paints and two brands of stretched canvas on the smoothness of paint applied to the canvas. Three replicates of each combination of factor A (paint) and factor B (canvas) are painted and smoothness of the paint is measured (higher values are smoother). The model fit is:

$$Y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \varepsilon_{ijk} \quad \varepsilon \sim N(0, \sigma^2) \quad i = 1, 2, 3 \quad j = 1, 2 \quad k = 1, 2, 3$$

- a) Give least squares estimates of the model parameters.
- b) Give the Analysis of Variance
- c) Test for interaction effects, and main effects for paint and canvas (each test at $\alpha = 0.05$).
- d) On graph paper give a plot of the treatment means for all combinations of paint and canvas.
- e) Use Tukey's method to compare all pairs of brands (main effects) with an experimentwise error rate of $\alpha = 0.05$
- f) Obtain the Analysis of variance, F -tests, and Tukey's comparison of brands using SAS:

```
options ps=55 ls=76;
data one;
input paint canvas rep smooth @@;
cards;
1 1 1 y111 1 1 2 y112 . . . 3 2 3 y332
;
run;
proc glm;
class paint canvas;
model smooth = paint canvas paint*canvas;
means paint / tukey;
run;
quit;
```

The data may cover more than one line

n	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y
a	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	3
m	1	1	1	2	2	2	1	1	1	2	2	2	1	1	1	2	2	2	2
e	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	3

ABALO ALBERTO A	80	81	79	54	52	50	70	78	77	52	47	49	60	60	66	48	45	41
BEKKER ILDIKO	82	80	78	50	52	49	75	81	77	44	50	48	59	59	57	41	37	39
BOND MATTHEW RO	78	77	80	48	51	56	73	79	75	50	50	49	69	62	59	45	39	38
CARROLL ROBERT	77	80	75	50	50	44	70	82	77	48	48	52	61	61	59	39	36	43
CHLUDZINSKI ALE	81	80	83	47	52	53	76	77	80	50	48	50	65	65	62	41	37	47
CROOKSHANKS CRI	76	84	78	56	51	47	78	75	75	50	46	47	60	56	60	46	41	47
CULLIN STEPHANI	73	75	72	45	54	53	78	77	73	47	53	46	57	57	63	41	40	43
DOLINSKAYA IRIN	74	85	74	52	56	49	81	79	79	54	45	50	64	63	62	44	40	42
DONAHUE JASON T	76	76	77	44	53	49	74	74	76	53	44	50	61	59	64	45	47	44
DUNN LINDSAY RA	77	74	76	54	53	52	79	75	72	49	50	55	60	64	58	40	37	38
ELLIOTT COURTNE	78	77	78	56	50	50	75	81	78	53	42	51	61	58	62	44	48	43
FISH JENNIFER K	81	80	77	52	53	56	72	72	74	47	50	50	59	63	61	44	47	45
FOLLERT JASON P	79	84	80	47	44	51	72	77	77	46	48	54	62	62	59	39	43	42
GOODALE SARAH E	79	82	76	54	46	51	74	76	81	51	50	51	59	58	58	39	45	48
HOANG VAN	84	75	81	49	54	52	72	78	78	45	47	52	63	58	61	44	45	42
KLEIN GABRIELLE	73	79	77	50	46	49	77	78	78	50	47	51	62	58	65	42	42	40
KUMANCHIK LACEY	77	78	80	51	49	53	73	77	76	46	49	48	59	59	63	45	40	43
KUO ANDREW	79	77	75	51	50	53	74	75	73	49	47	45	62	64	63	38	42	39
LATHAM KENZIE E	78	82	81	50	52	54	75	79	72	49	51	46	61	62	62	46	40	42
LI CATHERINE	72	75	84	50	51	45	77	81	72	42	45	51	58	67	63	44	43	38
LIU HUAZHI	75	80	86	51	56	50	77	75	79	53	48	55	59	61	63	45	44	39
MEDINA REINALDO	76	80	79	48	50	51	78	83	75	46	45	49	58	61	61	42	43	39
MINOR MELISSA D	79	81	76	53	53	51	75	73	81	49	50	48	62	61	65	42	42	44
O'BRIEN ROBERT	81	80	75	48	50	51	76	75	73	49	46	45	56	62	59	43	43	44
OBRIEN AMANDA M	79	81	80	53	51	50	76	78	76	52	53	47	58	61	58	44	45	41
ROMERO JOSE MAN	80	80	77	51	45	55	74	78	77	52	48	49	55	62	61	46	46	44
SHAH PARAS DIPA	73	79	84	52	52	50	75	74	75	47	51	46	57	54	65	45	46	45
WASOWSKI MIKOLA	79	76	82	53	48	55	72	76	78	53	46	49	61	65	62	47	38	37
JOSEPH WILLIAMS	81	84	75	59	48	51	72	82	75	49	48	52	58	59	61	43	43	42
YEN HSIAO CHI	77	80	76	60	46	50	79	74	83	49	47	46	66	58	63	42	37	43
ZDON THOMAS NEL	77	84	76	51	47	49	71	73	74	46	54	51	64	58	60	42	44	43