Design of Experiments Quiz A

Instructions: The purpose of this test is to evaluate the performance of the instructor and the general effectiveness of the course. The test does not necessarily indicate your performance in the course. It is a designed experiment. To keep your scores private a code number has been written on the title page of your textbook. Please write that code number on the top of your answer sheet. Your pre-course scores will be matched by the code number to your post-course scores for a similar test that will be given during the last class period. Your code number must also appear on the post-course test so do not lose your textbook. Please answer each question by circling your response on the attached answer sheet. The answer "I don't have a clue" is provided to give you an alternative to guessing at answers. Please use this choice if you can't eliminate some of the possible answers provided and make a reasonable guess from among the remaining few choices. This will give us a better indication of where you started and where you ended up.

1. An experiment is to be performed in which four different lots of material will be run on one machine to determine if there are differences between the lots. The number of variables in the experiment is:

   (a) 4
   (b) 1
   (c) 3
   (d) None of the above.
   (e) Don't have a clue

2. An experiment is to be performed to test three machines for possible differences between their means by measuring 10 parts off of each machine. How many error degrees of freedom will there be for the test?

   (a) $29 - 2 = 27$
   (b) $29 - 2 - 9 = 18$
   (c) $29 - 2 - 9 - 18 = 0$
   (d) None of the above.
   (e) Don't have a clue.

3. An ANOVA for a one-way classification problem tells you:

   (a) Which pair or pairs of means are different from each other.
   (b) If there are one or more pairs of means that are different from each other.
   (c) If there are one or more means that are different from the grand mean.
   (d) If there are one or more pairs of variances that are different from each other.
   (e) Don't have a clue.

4. For the ANOVA output below which statement is true?

$Source$	df	SS	MS	F	p
$Team$	2	52.2	21.6	1.87	0.173
$Dice$	2	422.2	210.6	15.1	0.000
$Team * Dice$	4	89.2	22.3	1.60	0.203
$Error$	27	376.5	13.9		
$Total$	35	939.0			

   (a) The number of observations is 35, teams is 2, and dice is 2.

   (b) The number of observations is 36, teams is 2, and dice is 2.

   (c) The number of observations is 36, teams is 3, and dice is 3.

   (d) The number of observations is 35, teams is 3, and dice is 3.

   (e) None of the above.

   (f) Don't have a clue.

5. For the ANOVA output above, the standard error of the model is:

   (a) 27

   (b) 13.9

   (c) $\sqrt{13.9}$

   (d) 376.5

   (e) $\sqrt{376.5}$

   (f) None of the above.

   (g) Don't have a clue.

6. In a two variable experiment with 3 levels of the first variable, 4 levels of the second, and two replicates, how many degrees of freedom will there be to determine the interaction effect?

   (a) 12

   (b) 6

   (c) 7

   (d) 2

   (e) None of the above.

   (f) Don't have a clue.

7. If the r^2 in a linear regression model is high (e.g. >90%) then:

   (a) The model provides a good fit to the data.

   (b) The model might provide a good fit to the data.

   (c) 90% of the variability in the response is explained by the error.

   (d) The model is accurate for interpolation of the response within the experimental design space.

   (e) Don't have a clue.

8. In linear regression, a variable transformation should be applied to:

   (a) The independent variable if possible so that the model residuals retain the same units as the response.
   (b) The dependent variable if possible so that the model residuals retain the same units as the response.
   (c) Provide the highest possible value of r^2 regardless of whether the tranformation is based on first principles of physics, chemistry, mechanics, etc.
   (d) Don't have a clue.

9. If temperature is a design variable in an experiment, and if the low and high levels for temperature are 30C and 50C, respectively, then what temperature corresponds to the coded level 0.4?

   (a) 44C
   (b) 34C
   (c) 38C
   (d) 40.4C
   (e) Don't have a clue.

10. How many levels of each variable are there in a 2^4 factorial experiment?

    (a) 1
    (b) 2
    (c) 4
    (d) 16
    (e) Not enough information is given.
    (f) Don't have a clue.

11. All of the variables in a 2^n experiment must be:

    (a) Qualitative
    (b) Quantitative
    (c) Ordinal
    (d) Qualitative or quantitative
    (e) Not enough information is given.
    (f) Don't have a clue.

12. In a 2^3 experiment with two replicates how many total, model, and error degrees of freedom are there if only main effects and two-factor interactions are included in the model?

    (a) 8, 6, 2
    (b) 7, 6, 1
    (c) 16, 6, 10
    (d) 15, 6, 9
    (e) 15, 3, 12
    (f) Don't have a clue.

13. Center cells are added to a 2^n experiment for the purpose of:

    (a) Adding error degrees of freedom without unbalancing the experiment.
    (b) Adding error degrees of freedom without the need to replicate the experiment.
    (c) Providing an opportunity to test for evidence of linear lack of fit.
    (d) All of the above.
    (e) Don't have a clue.

14. If a 2^3 full-factorial experiment is to be built with a total of 32 runs:

    (a) Four consecutive measurements should be taken at each of the 8 configurations to get the most consistent results.
    (b) All 32 runs should be performed in completely random order.
    (c) The experiment should be built in two blocks of 16 runs.
    (d) The experiment should be built in four blocks of 8 runs.
    (e) b would be OK, c would be better, but d would be best.
    (f) Don't have a clue.

15. How many unique runs are required to build a 2^{7-3} experiment?

    (a) 8
    (b) 16
    (c) 7
    (d) 15
    (e) Don't have a clue

16. How many generators must be used to build the 2^{7-3} experiment?

    (a) 3
    (b) 4
    (c) 7
    (d) Not enough information is given.
    (e) Don't have a clue.

17. If the generator for a half-fractional factorial design of resolution V is 5=1234 then:

    (a) There are five variables in the experiment
    (b) The experiment will have 16 unique runs
    (c) 1=2345
    (d) 13=245
    (e) all of a-d
    (f) None of the above.
    (g) Don't have a clue.

18. In a resolution IV design:

    (a) Main effects are confounded with four-factor interactions.
    (b) The design must be a half replicate of a full factorial design
    (c) There must be at least three variables in the experiment.
    (d) The experiment will resolve quadratic terms.
    (e) a, b, and c
    (f) None of a, b, c, and d.
    (g) Don't have a clue.

19. How many 1/8th fractional factorial designs have to be combined to construct a 2^{8-1} experiment?

    (a) Four complementary 1/8th fractions
    (b) Two complementary 1/8th fractions
    (c) Four replicates of one 1/8th fractional factorial.
    (d) Two replicates of one 1/8th fractional factorial.
    (e) None of the above.
    (f) Don't have a clue.

20. A 2^4 plus centers experiment can resolve all quadratic terms in the experiment.

    (a) True
    (b) False
    (c) Not enough information is given
    (d) Don't have a clue.

21. Examples of screening experiments are:

    (a) Box-Behnken designs
    (b) Central composite designs
    (c) Plackett-Burman designs
    (d) Highly fractionated factorial designs
    (e) a and b
    (f) c and d
    (g) Don't have a clue

22. You can check for the independence of two study variables using a:

    (a) Levene's test.
    (b) Correlaton matrix.
    (c) Normal plot of residuals.
    (d) Boxplots or dotplots of residuals.
    (e) None of the above.
    (f) Don't have a clue.

23. Model residuals are:

    (a) Observations that fall an unexpectedly far distance from their predicted values.
    (b) The plastic frames and flashing left over after you've used all of the plastic parts.
    (c) The discrepancies between the observed and predicted values.
    (d) Extraneous terms that don't contribute significantly to the model.
    (e) Don't have a clue.

24. Which of the following analysis techniques would be used to analyze an experiment with three qualitative variables where each variable has two or more levels?

    (a) ANOVA
    (b) Regression
    (c) General Linear Model
    (d) Binary logistic regression
    (e) a and c
    (f) Don't have a clue.