

Practice Problems for Final Exam
ENGR 120

Note: *Do not assume that this practice exam represents every type of problem that you may see on your exam, or that the percentage values for each set of problems on this exam will be the same as those on your exam.*

Part I. Written Exam

This part of the exam is closed book, closed notes. You may use a calculator. You may write ONLY on this exam.

Fill in the Blank:

1. The coefficient of determination (R^2) is an indication of _____
_____.
2. A joule (IS, IS NOT) equivalent to a Newton-meter.
3. If the mass of water in the Ruston water tower is 1Mg (mega-gram) and it is positioned at an average height of 50m, it must have a potential energy of _____.
4. A set of data points that line up in a straight line when plotted on semi-log paper would most likely follow which form of equation? _____

Multiple Choice:

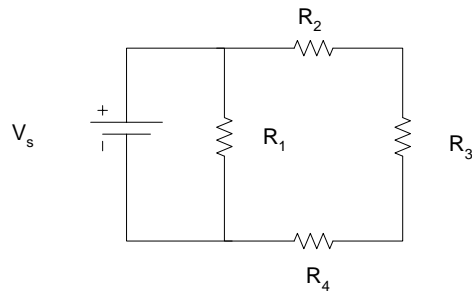


Figure 1. Circuit diagram for Multiple Choice Questions 1-2. For this diagram, $V_s = 20\text{V}$, $R_1 = 50\Omega$, $R_2 = 20\Omega$, $R_3 = 30\Omega$, and $R_4 = 40\Omega$:

1. The overall equivalent resistance (R_{eq}) for the circuit in Figure 1 is most nearly:
 - a. 140Ω
 - b. 32.1Ω
 - c. 35.8Ω
 - d. None of the above

2. If R_{eq} for the circuit in Figure 1 is 100Ω (It is *not*, but assume for this problem that it is.), then the power generated by the voltage source is most nearly:
 - a. 0.5W
 - b. 1.0W
 - c. 4.0W
 - d. 5.0W

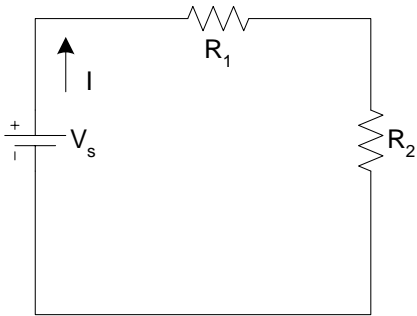


Figure 2. Circuit Diagram for Multiple Choice Questions 3-4. For this diagram, $V_s = 20\text{V}$, $R_1 = 50\Omega$, and $I = 0.2\text{A}$

3. The power generated by the voltage source is most nearly:
 - a. 2W
 - b. 4W
 - c. 8W
 - d. Cannot be determined from the information given.

4. The value of R_2 is most nearly:
 - a. 50Ω
 - b. 100Ω
 - c. 150Ω
 - d. Cannot be determined from the information given.

5. The efficiency of an electric drill that produces 1 HP (745.7 Joules/second) when supplied with 10A of current at 115V is most nearly:
- a. 1%
 - b. 10%
 - c. 65%
 - d. 90%
6. A pump requires 1.5kW to raise 5000L of gasoline 10 meters in a half-hour. If the velocity of the gasoline is 5 m/s, and the density of gasoline is 670 kg/m^3 , then the efficiency of the pump is most nearly:
- a. 1%
 - b. 14%
 - c. 20.45%
 - d. 35%

A geneticist is looking at the growth rate of an HIV virus. She has gathered the following data about how fast the virus is growing

Hour	No. of Viruses
1	10
5	20
10	30
15	37

Based on a visual inspection of the numbers, she is guessing that the rate of growth fits an exponential curve.

7. Assuming that the best fit for the data is in fact an exponential curve, then the best regression equation for the data is (assuming $y = \text{No. of viruses}$ and $x = \text{Hour}$):
 - a. $y = 1.9255x + 9.3273$
 - b. $y = 9.7767 x^{0.4819}$
 - c. $10.743 e^{0.0908x}$
 - d. None of the above

8. Given the regression curve you developed for Problem 7, do you agree that an exponential curve is a good fit for the data?
 - a. Yes, because the R^2 value is high.
 - b. No, because the R^2 value is low.
 - c. Either (a) or (b) is a valid response.

NASA has been tracking the average global temperature from 1980 through to today. Given the data provided for 1985-1989, you believe that a straight line will be the best fit.

Year	Avg. Global Temp
1985	15.17
1986	15.23
1987	15.38
1988	15.41
1989	15.29

9. Assuming that the best fit for the data is in fact a straight line, then the best regression equation for the data is (assuming $y = \text{Avg. Global Temp}$ and $x = \text{Year}$):
- $y = 0.042x - 68.158$
 - $y = 0.015x - 70.124$
 - $y = 0.02x - 80.3$
 - None of the above
10. Given the regression curve you developed for Problem 7, do you agree that a linear curve (straight line) is a good fit for the data?
- Yes, because the R^2 value is high.
 - No, because the R^2 value is low.
 - Either (a) or (b) is a valid response.

Part II. Computer Exam

1. (*Excel*) Beginning with Aug. 31, 2006, one of your professors has tracked the number of entries contained in the online encyclopedia Wikipedia, and has produced the following table, where Day 0 represents 8/31/06 and Day 434 represents 11/8/07:

Day	# of Entries
0	1,356,724
77	1,486,871
109	1,539,070
190	1,676,896
407	2,044,879
431	2,077,344

Use linear regression in Microsoft EXCEL (a trendline analysis) to determine whether the best fit for the increasing number of entries is a linear, exponential, or power curve. Write your choice here: _____

The best curve for the data presented in the table is: _____

The R^2 value for the curve is: _____

2. (*robot*) Write a program to move your robot approximately 2 feet forward at the rate of about 1 in/s. As the robot moves forward, an LED should blink rapidly (0.25 s on; 0.25 s off) when the photo-resistor senses darkness; the LED should blink slowly (0.75 s on; 0.25 s off) when the photo-resistor senses light. Download your program to the robot and demonstrate its operation to the instructor.
3. (*Mathcad*) A steam power plant that uses coal for fuel runs at 33% efficiency. If it produces 3500hp, then:
- How much power from coal will it need, in hp?
 - If coal supplies 12000 BTU of energy per lbm, then how much coal will the plant need to run for an hour?
4. (*SolidWorks*) Create a part file that represents the part with the dimensions as shown . . . (parts and assemblies such as the pump)