MATH 156 PRACTICE PROBLEMS

1. Convert 3207_8 to decimal.

2. Convert $ACF7_{16}$ to decimal.

3. Convert $D3.C5_{16}$ to decimal. Round your answer to three decimal places.

4. a) Convert 621_{10} to octal.
b) Convert 0.84375_{10} to base 4.

5. Convert 125.21875_{10} to hexadecimal.

6. Convert 54.525_{10} to base 5.

7. Convert 0.1_{10} to binary.

8. Convert:
a) 37.14_8 to binary
b) 101011.11011_2 to hexadecimal
c) $AD.84_{16}$ to octal

9. State YES, NO or MAYBE.
a) Leah walked and biked today. Did she walk today?
b) Leah walked or biked today. Did she walk today?
c) Leah walked or biked today but not both. Did she walk or bike today?
d) Leah biked today. Did she not bike today?
e) Leah biked today. Did she walk or bike today?
f) Leah biked today. Did she walk and bike today?

10. A student club has five members. Are the following sentences negations of one another?
a) All members showed up to the meeting. No members showed up to the meeting.
b) At least one member showed up to the meeting. No members showed up to the meeting.
c) At least one member didn't show up to the meeting. All members showed up to the meeting.

d) At least three members showed up to the meeting. At most three members showed up to the meeting.
e) At least three members showed up to the meeting. At most two members showed up to the meeting.

11. Let c = "coffee was served" and let t = "tea was served." Translate the following to logical symbols:
a) Coffee or tea was served but not both.
b) Coffee was served but tea was not.
c) Coffee was served and either coffee or tea were served.
d) Either coffee was served or coffee and tea were served.

12. Draw the Venn diagram for $p \wedge (\sim q \vee r)$.

13. Build the truth table for $(p \oplus \sim q) \wedge r$.

14. Is $(p \vee \sim q) \wedge q$ logically equivalent to $p \wedge q$? Justify your answer by building a truth table.

15. Draw the gate representation for $(A + \overline{B})C$.

16. Simplify using a truth table:
$\overline{B} + \overline{B}A$

17. Use the laws of logic to simplify $(p \wedge (p \wedge q)) \vee (q \wedge \sim q)$.

18. Use the laws of logic to show that $A\overline{B}(B + C + \overline{B + C}) + \overline{B}A$ is logically equivalent to $\overline{B}A$.

19. Use the laws of logic to simplify $(\overline{B + A} + \overline{B}A)(B + \overline{A})$.

20. Use the laws of logic to show that $\sim (\sim p \wedge \sim q) \wedge (p \wedge \sim r)$ is logically equivalent to $p \wedge \sim r$.

21. The following is true: "If Penny is awake then her phone is on."
Answer YES, NO or MAYBE.
a) Penny's phone is on. Is she awake?
b) Penny's phone is not on. Is she awake?

c) Penny is awake. Is her phone on?

d) Penny is not awake. Is her phone on?

22. Original statement: "If prets pam then unks ulp."
Is the statement the converse, inverse or contrapositive of the original statement? Is it logically equivalent to the original statement?

a) If unks don't ulp then prets don't pam.

b) If unks ulp then prets pam.

c) If prets don't pam then unks don't ulp.

23. The following is true: "Mups are not red if and only if noks are green."
Answer YES, NO or MAYBE.

a) Noks are green. Are mups red?

b) Noks are not green. Are mups red?

c) Mups are red. Are noks green?

d) Mups are not red. Are noks green?

24. a) Write a general formula for: $\sqrt{2}, \sqrt{3}, 2, \sqrt{5}, \sqrt{6}, \sqrt{7}$.

b) Write a recursive formula for: $6, 8, 10, ...$

25. Evaluate $\sum_{i=3}^{8}(2^i - 3)$.

26. Find a general formula and simplify it: $-38, -41, -44, ...$

27. An arithmetic sequence has $a_8 = -15$ and $a_{21} = -67$. Find a_1 and d.

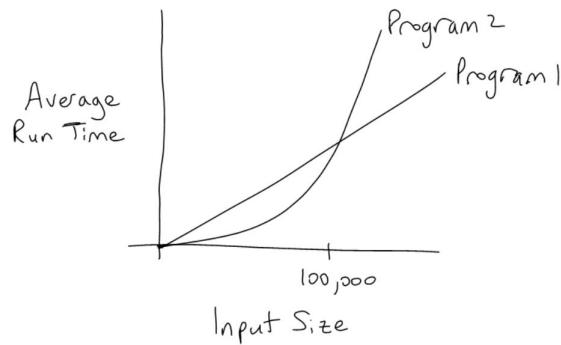28. Evaluate $\sum_{i=3}^{43}(5i + 2)$.

29. Give a recursive formula for: $81, 27, 9, ...$

30. Calculate a_{20}, assuming that the first term is a_1:
$4, -8, 16, -32, ...$

31. Consider $1000 + 500 + 250 + ...$

a) Calculate S_{12}.

b) Calculate S_∞, if it exists.

32. Consider the following graph:

a) Which program performs best for very small input sizes?
b) Which program performs best for very large input sizes?
c) What input size is the breakeven point between the two programs?

33. Give the order of the following expressions:
a) $7n^2 + 8$
b) 300^2
c) $7n + 8$
d) $6n^2 + 8(2^n)$
e) $6n^2 + 9n!$
f) $8(2^n) + 9n!$
g) $2n(50 + \log n)$
h) $1000 + 2\log n$
i) $100n + 2\log n$

34. Write the following from smallest to largest:
$O(n \log n), O(n^2), O(n!), O(1), O(2^n), O(n), O(\log n)$.

35. A car rental company is building a database for its vehicles. For each vehicle it records the make (Toyota, Honda etc.), distance displayed on odometer (to the nearest kilometre), and diameter of front left tire.
a) State the experimental unit.
b) List the variables and indicate what type of variable they are.

36. Consider the histogram below.
a) Describe the shape.
b) List any outliers.
c) State the mode or modes.
d) What percentage of grades were under 40%?

Grades in a Course (%)
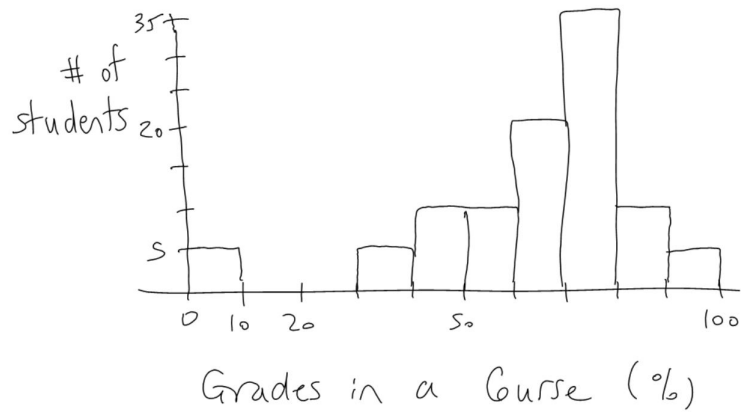
37. State the primary problem with the following:

Do You Like Stats?
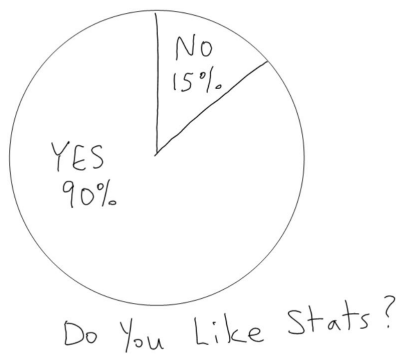
38. Consider the following sample: $23, 9, 17, 13$.
a) Calculate the mean.
b) Calculate the median.
c) Add 5 to every measurement in the sample. Find the new median.
d) Multiply every measurement in the sample by 2. Find the new median.
e) Multiply only the largest measurement in the sample by 2. Find the new median.

39. Which data set has the larger standard deviation, or are the standard deviations equal?
a)
Data Set A: 1, 5, 9
Data Set B: 2, 10, 18
b)
Data Set A: 1, 5, 9
Data Set B: 3, 7, 11
c)
Data Set A: 1, 5, 9
Data Set B: 4, 5, 6

40. The mean of a data set is 30 and the standard deviation is 5. Find the range in which at least 93.75% of the measurements fall.

41. Grades on a midterm were mound-shaped, with a mean of 70 and a standard deviation of 6. What percentage of grades were less than 52?

42. A student scored 80 on the math final exam, which had a mean of 70 and a standard deviation of 5. The student scored 78 on the physics final exam, which had a mean of 72 and a standard deviation of 2. In which course did the student do better relative to the class?

43. A Canadian online store has a database listing all of its clients. For each client, the following info is listed: name, email address, province, and age-group (youth, adult or senior). Name the sampling method:
a) Using random numbers, some clients are selected from each age-group.
b) Every 50th client is selected from the database, starting with the 3rd client.
c) Clients are selected using random numbers.
d) A few provinces are randomly chosen, and all clients from those provinces are selected.

44. Managers at a software company want to know if coders are more productive, on average, at certain times of day. State whether the study is observational or experimental.
a) Coders are randomly divided into two teams. The early team starts work at 8am and the late team starts work at 11am. After one month the productivity of the two teams is compared.
b) Using last year's data, the work hours and productivity of all coders are analyzed.

45. State the primary problem with the following statistical statement:
The mean house price in the town of Gallia, BC is $1.2 million.

46. How many 4-symbol passwords are there if:
a) passwords are alphanumeric but not case-sensitive?
b) passwords are alphanumeric, not case-sensitive, and must contain at least one letter?

47. How many 3-digit PINs (consisting entirely of numbers):
a) start with 8?
b) end with 13?
c) start with 8 and end with 13?
d) start with 8 or end with 13?

48. Consider all the flights leaving Vancouver International Airport on one day. Data was collected on the destination and whether the flight left on time.

	On Time	Late
Canada	312	138
US	120	80
International	98	52

Find the probability that a randomly-chosen flight:
a) had an international destination
b) was not destined for Canada
c) was headed to the US and left late
d) was headed to the US or left late

49. Lifetimes for a certain brand of laptop are normally distributed with a mean of 7 years and a standard deviation of 2 years. State whether the probability is 0%, strictly between 0% and 50%, or at least 50%.

a) The probability that a randomly-chosen laptop lasts 3 to 4 years
b) The probability that a randomly-chosen laptop lasts at least 5 years
c) The probability that a randomly-chosen laptop lasts exactly 6 years

50. Noise levels at 100 randomly-chosen downtown intersections at rush hour had a mean of 70.2 decibels and a standard deviation of 8.1 decibels.
a) Find a 90% confidence interval for the average noise level at a downtown intersection at rush hour.
b) What would happen to the confidence interval if the sample size were increased?