This space, and the one on the back of the cover page, intentionally left blank.
Any information written here will NOT be graded.

Problem 1: Multiple Choice – Circle the Correct Answers [9 Marks]

1) [1 mark] The percentage of Bachelor's degrees conferred to women in the U.S. has increased significantly in the past 30 years in all but one of the following fields, where it has decreased significantly. Which field is the one exception?

    a. Computer Science

    b. Engineering

    c. Mathematics and Statistics

    d. Physical Sciences

2) [5 marks]Facebook collects personal data on its users from which of the following sources? Circle all that apply.

    a. Personal data that users provide, e.g., when setting up a profile on Facebook.

    b. Data that describes devices, ISP providers etc. that users use to access Facebook.

    c. Data that describes users' behaviour on other websites, while logged on to Facebook (e.g., ads clicked).

    d. Data on some websites that you visit while *not* logged on to Facebook.

    e. Data from trusted third-party partners.

3) [1 mark] When do most experts think that superintelligence will arrive?

    a. In the next 10 years

    b. In the next 10-25 years

    c. In more than 25 years

    d. never

4) [1 mark] What is the best way of combining these DNA sequences?

1.GTTAA
2.AACGT
3.TCCGA
4.GAACG

a. TCCGAACGTTAA

b. GTTAACGTCCGAACG

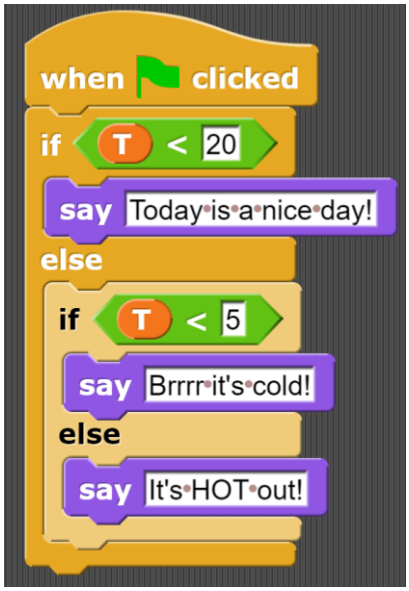
c. GTTAACGTCGAACG

d. All of the above

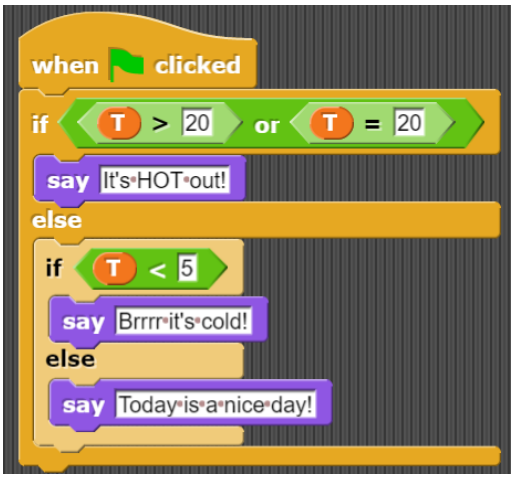
e. None of the above

5) [1 mark] Circle the algorithm that is equivalent to the one above

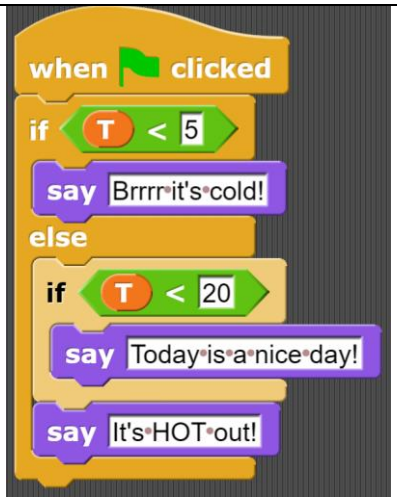
a.



b.



c.



d.

e. None are equivalent.

Problem 2: Define this [6 marks]

Expand the following acronyms to their full version as discussed in class. Note that adding additional definitions may result in your losing points. No need to provide anything beyond just listing the expansion of the acronym. E.g., if the question was “URL” the answer should be “Uniform Resource Locator”.

1. [1 mark] DOS attack

2. [1 mark] DNS

3. [1 mark] ML

4. [1 mark] NLP

5. [1 mark] OS

6. [1 mark] RAM

Problem 3: The Internet [8 Marks]

1) [1 mark] What information does a TCP/IP packet contain?

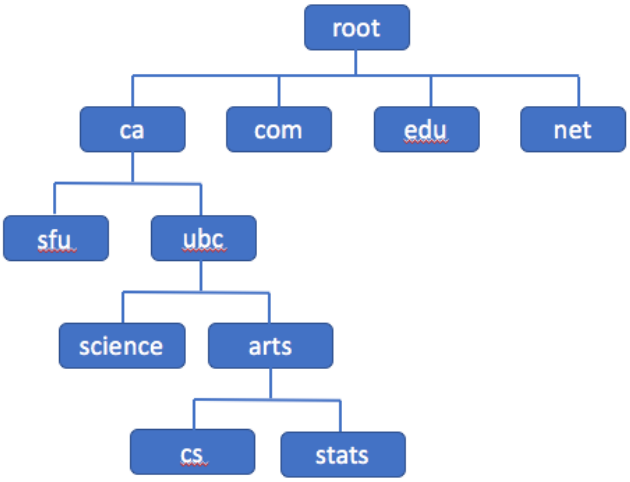
2) [3 marks] Suppose you are sending an email, which is broken into packets for transmission over the internet. State whether each of the following is true or false.

   a) All of the packets are sent along the same path to the destination. True False

   b) The packets may arrive out of order. True False

   c) Some packets may not arrive at all. True False

3) Following is a representation of a domain name hierarchy:



   a) [1 mark] Add the domain stats.ubc.net to the above representation

   b) [2 marks] Which domain is more related to stats.arts.ubc.ca: stats.ubc.net or science.ubc.ca. Why?

   c) [1 mark] Give an example of a top-level domain shown in this diagram.

Problem 4: Data Representation [5 Marks]

1) [1 mark] The RGB setting for blue is: Circle one:

    a. 00 00 00

    b. FF 00 00

    c. 00 FF 00

    d. 00 00 FF

    e. FF FF FF

2) [2 marks] Translate the following decimal number to binary: 343

3) [2 marks] Translate the following hexadecimal number to decimal: 0xA866

Problem 5: Algorithms [4 Marks]

A music critic completes an article for a magazine, and realizes that he has confused two musicians: Jay-Z and Kanye. Before submitting the article, he needs to change all occurrences of "Jay-Z" to "Kanye" and all occurrences of "Kanye" to "Jay-Z". The critic will use the fact that the word "Hozier" does not appear anywhere in the article.

Which of the following algorithms can be used to accomplish the music critic's goal? Circle all that are correct.

(a) First, change all occurrences of "Jay-Z" to "Kanye"
Then, change all occurrences of "Kanye" to "Jay-Z."

(b) First, change all occurrences of "Jay-Z" to "Kanye."
Then, change all occurrences of "Kanye" to "Jay-Z."
Last, change all occurrences of "Hozier" to "Kanye."

(c) First, change all occurrences of "Jay-Z" to "Hozier."
Then, change all occurrences of "Kanye" to "Jay-Z."
Last, change all occurrences of "Hozier" to "Kanye."

(d) First, change all occurrences of "Jay-Z" to "Hozier."
Then, change all occurrences of "Hozier" to "Kanye."
Last, change all occurrences of "Kanye" to "Jay-Z."

Problem 6: Algorithms [4 Marks]

There are 32 students standing in a classroom. Two different algorithms are given for finding the average height of the students.

Algorithm A
Step 1: All students stand.
Step 2: A randomly selected student writes his or her height on a card and is seated.
Step 3: A randomly selected standing student adds his or her height to the value on the card, records the new value on the card, and is seated. The previous value on the card is erased.
Step 4: Repeat step 3 until no students remain standing.
Step 5: The sum on the card is divided by 32. The result is given to the teacher.

Algorithm B
Step 1: All students stand.
Step 2: Each student is given a card. Each student writes his or her height on the card.
Step 3: Standing students form random pairs at the same time. Each pair adds the numbers written on their cards and writes the result on one student's card; the other student is seated. The previous value on the card is erased.
Step 4: Repeat step 3 until one student remains standing.
Step 5: The sum on the last student's card is divided by 32. The result is given to the teacher.

Which of the following statements are true? Circle your answers.

(a) Algorithm A always calculates the correct average, but Algorithm B does not.

(b) Algorithm B always calculates the correct average, but Algorithm A does not.

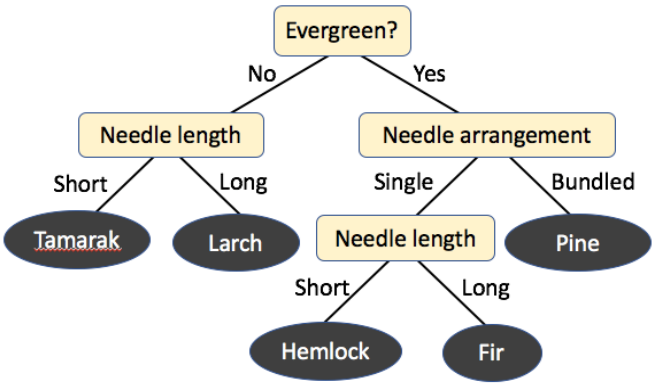
(c) Both Algorithm A and Algorithm B always calculate the correct average.

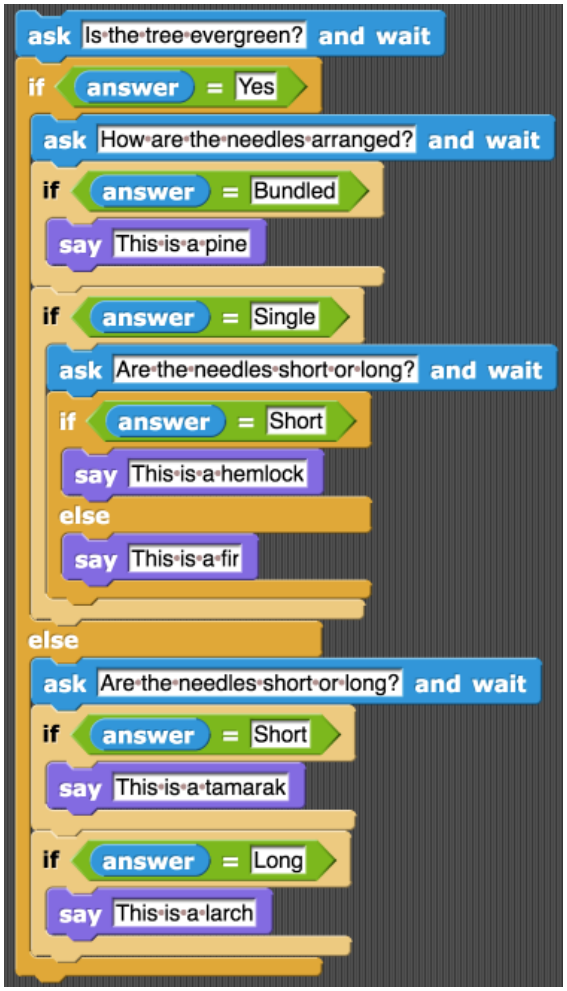
(d) Neither Algorithm A nor Algorithm B calculates the correct average.

Problem 7: Decision Trees on Trees [7 Marks]

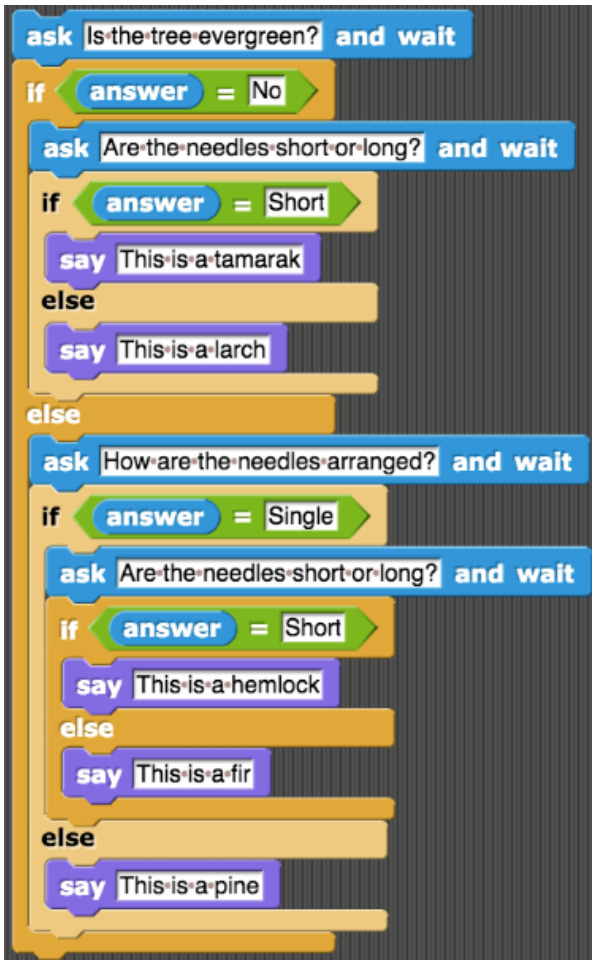
Below is a table of training data identifying some coniferous trees, along with a corresponding decision tree and some Snap! code fragments.

Evergreen?	Needle length	Needle arrangement?	Tree type
No	Short	Tufted	**Tamarak**
No	Long	Tufted	**Larch**
Yes	Short	Single	**Hemlock**
Yes	Short	Bundled	**Pine**
Yes	Long	Single	**Fir**





Left



Right

1) [1 mark] How many nodes does the decision tree have?

2) [1 mark] How many leaves does the decision tree have?

3) [1 mark] Which of the Snap! Code fragments correctly implement the decision tree algorithm? Circle one.

A. Left B. Right. C. Neither Left nor Right. D. Both Left and Right.

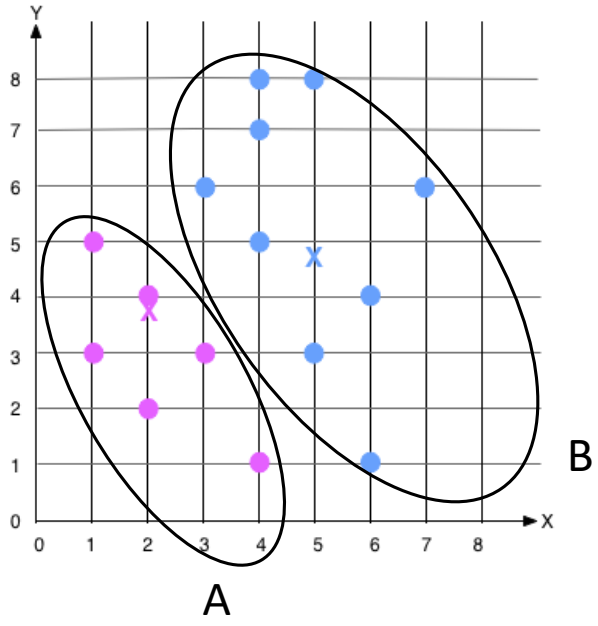
4) [1 mark] When building decision trees, why is it advantageous to have as few nodes as possible?

5) [3 marks] In the space below, draw a valid decision tree with *fewer* nodes than that shown on the previous page, for the same training data. Show your work. (The table is repeated here for convenience.)

Evergreen?	Needle length	Needle arrangement?	Tree type
No	Short	Tufted	**Tamarak**
No	Long	Tufted	**Larch**
Yes	Short	Single	**Hemlock**
Yes	Short	Bundled	**Pine**
Yes	Long	Single	**Fir**

Problem 8: k-means clustering [6 marks]

Consider the following diagram which shows a set of points (the circles), initial centroids (the x's), and cluster assignments (as shown by the ovals). For any necessary math, you may leave your answer as the expression rather than by doing the calculations, e.g., if your answer is $2^{10} = 1024$, you may leave your answer as 2^{10}



1) [4 marks] Choose the new centroids for Clusters A and B

   Cluster A's X value:

   Cluster A's Y value:

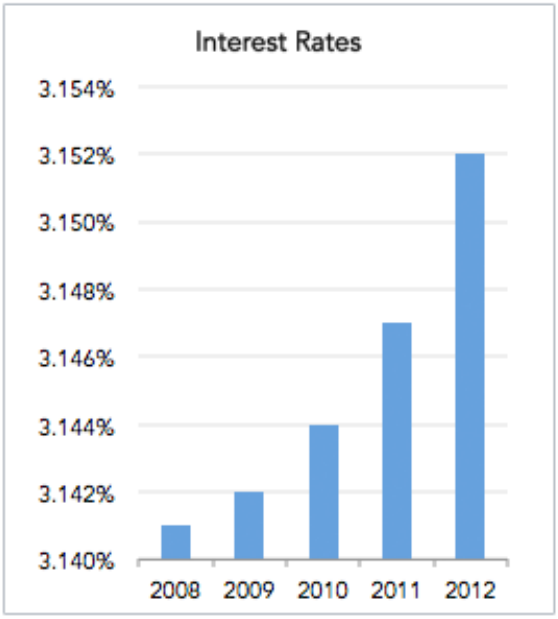
   Cluster B's X value:

   Cluster B's Y value:

2) [2 marks] Will you need to recalculate the centroids again? (i.e., how do you know when you can stop?) If you need additional information, what information you need?

Problem 9: Visualization [8 marks]

1) [2 marks] Is this graph misleading? Why or why not?



2) [2 marks] Which is more appropriate for showing the percentage of English native speakers in Vancouver, a line chart or a pie chart? Why?

3) [2 marks] If you want to find out how you did relative to your classmates in an exam (i.e., which percentile you were in), which would you use: mean, median, or mode? Why?

4) [2 marks] What are two factors that we covered in class that you should consider whether an infographic or statistic is misleading? Note: we will only grade the first two factors that you list.

Problem 10: Artificial Intelligence [5 Marks]

1) [1 mark] Searle wrote that "A fair number of researchers in artificial intelligence (AI) believe [...] that by designing the right programs with the right inputs and outputs, they are literally creating minds."

   Does Searle consider such researchers to be proponents of Strong AI or Weak AI? Circle one.

   Strong AI Weak AI

2) [1 mark] True or False: With his "Chinese room argument", Searle aimed to establish that is it impossible to create artificial thinking systems.

   True False

3) [1 mark] Describe a difference that you observed in the responses of Eliza and Cleverbot. Be as concrete as possible.

4) [1 mark] Do you think that Turing would consider Cleverbot to be intelligent? Explain your answer.

5) [1 mark] Do you think that Strong AI would consider that Cleverbot understands? Explain your answer.

Problem 11: Artificial Intelligence Impact [3 marks]

1) [1 mark] What is an argument from lecture against the claim that artificial intelligence will lead to higher levels of unemployment?

2) [2 marks] Consider the list of responsibilities of data entry clerks:
    - Read source documents such as checks, sales reports, or bills
    - Operate data entry device, such as keyboard or scanner
    - Compile, sort, and verify data
    - Compare data with source documents
    - Preparing materials for printing
    - Report errors

    Is it likely that this job will be automated in the next 20 years? Why?

Problem 12: Natural Language Processing [7 marks]

Lexicon	
binoculars	Noun
birdwatcher	Noun
child	Noun
sees	Verb
the	Article
with	Preposition

Grammar	
Sentence	→ NounPhrase, VerbPhrase
NounPhrase	→ Article, Noun
NounPhrase	→ NounPhrase, PrepositionalPhrase
PrepositionalPhrase	→ Preposition, NounPhrase
VerbPhrase	→ Verb, NounPhrase
VerbPhrase	→ Verb

1) [1 mark] What is parsing?

2) [2 marks] Using the lexicon and grammar above, draw a parse tree representing a possible parsing of the sentence "The child sees the birdwatcher."

3) [1 mark] What steps in natural language processing can help to resolve ambiguity that may arise in parsing? Circle one answer.

   A. Semantic analysis.

   B. Pragmatics.

   C. Both semantic analysis and pragmatics.

4) [1 mark] Give an example of a way in which parsing was successfully used by Watson to answer Jeopardy questions.

5) [1 mark] Describe a key difference between traditional NLP approaches versus machine learning approaches (such as artificial neural networks) to natural language processing.

6) [1 mark] What is an example of an adversarial attack in the context of machine learning models (such as neural networks)?

Problem 13: To infinity… and beyond! [3 marks]

1) [1 mark] What is an application of bioinformatics as discussed in class?

2) [1 mark] What is a potential technical advantage to using a database as covered in class?

3) [1 mark] Give one technological reason presented in class why quantum computing is not likely to be coming to your laptop any time soon.