Instructions

1. **All electronic devices are to be turned off and put away.**
2. **This is a closed-book quiz.**
3. **Answer the questions in the spaces provided.**
4. **Final answers to written questions should be rounded to THREE DECIMAL PLACES, or left in fraction form, where appropriate**
5. **Only question pages will be marked.**
6. **You may tear off the last page and use it for rough work. All pages will be collected at the end of the quiz.**
7. **Only a non-programmable, non-graphical calculator with a pink-tie or blue-goggle sticker will be allowed. No other aids are allowed.**
8. **DO NOT WRITE ON THIS COVER PAGE.**

Marking Scheme:

Questions	Out of
1 – 9	9
10	11
11	6
Total	26

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Part 1: Multiple Choice – Each question is worth 1 mark

Please CLEARLY CIRCLE your answer selection on this page. Do NOT simply write your choice next to the question. If you do, the question will not be graded. Each question has one correct answer. Choose the best answer.

1. Even though he is not a fan of the Toronto Blue Jays (Professional Major League Baseball team) fan, Terry does follow the team's progress. Terry has many friends who believe that the Blue Jays will definitely win the World Series within the next five years. He does not believe this to be true. However, Terry does believe that there is a 33% chance that the Blue Jays will win the World Series within the next five years. The type of probability being used here is:

A) Classical probability
B) Subjective probability
C) Relative frequency probability

- **This probability is based on nothing more than an opinion.**

2. To determine whether the waiting time to be served is less than 5 minutes at the Tim Horton's in the SLC, the waiting times of 200 customers were observed over a 3-hour period. It was found that 113 customers out of the 200 experienced a wait of less than 5 minutes. Tim Horton's in the SLC declares that the probability of waiting less than 5 minutes is 113/200 = 0.565. Which definition of probability best describes the above scenario?

A) Classical probability
B) Subjective probability
C) Relative frequency probability

- **The statement is based on a long series of repetitions of an experiment or process -- in this case, the observation of waiting times for a large number of customers. For this reason, the relative frequency definition is the best choice to describe the situation.**

3. A fair coin is to be flipped three times. "Fair" implies that each face is equally likely to occur. What is the probability that the same face will not appear two or more times in a row?

A) 3/4 B) 1/2 **C) 1/4** D) 1/8 E) None of these

- **There are a total of 8 outcomes / points in this experiment.**
- **In this case:**
- **S = {(T, T, T), (T, T, H), (T, H, T), (H, T, T), (T, H, H), (H, T, H), (H, H, T), (H, H, H)}.**
- **The outcomes "the same face will not appear two or more times in a row" correspond to (T, H, T) and (H, T, H).**
- **Thus, the probability that the same face will not appear two or more times in a row is 2/8 = 1/4.**

4. A student and a professor each choose a number between 3 and 8 (3 and 8 are each possible choices). What is the probability that the two choose the same number?

A) 1/2 B) 5/6 **C) 1/6** D) 1/5 E) None of these

- **If we let one person select a number. It doesn't matter what actual number is selected. Since there are 6 numbers to choose from, the probability that the second person picks the same number as the first person is simply 1/6.**

Use the following information to answer the next TWO questions:

Three numbers from {1, 2, 3, 4, 5} are to be chosen without replacement.

5. How many outcomes are in the sample space for this experiment?

A) 5 **B) 10** C) 15 D) 20

- **In this case, S = {(1, 2, 3), (1, 2, 4), (1, 2, 5), (1, 3, 4), (1, 3, 5), (1, 4, 5), (2, 3, 4), (2, 3, 5), (2, 4, 5), (3, 4, 5)}.**
- **So, there are a total of 10 outcomes (or points) in the sample space.**

6. What is the probability that at least two of the numbers chosen are even?

A) 0.3 B) 0.5 C) 0.6 D) 0.7 E) None of these

- **As noted above, there are 10 outcomes (or points) in the sample space. The points / outcomes satisfying "at least two of the numbers chosen are even" is: (1, 2, 4), (2, 3, 4), (2, 4, 5).**
- **So, the probability that at least two of the numbers are even is 3/10 = 0.3.**
- **Note: This would be the same as P(exactly two of the numbers are even) as it is not possible to choose three even numbers.**

7. A fair die is to be rolled two times. What is the probability that the product of the two numbers is odd?

A) 1/9 B) 1/6 **C) 1/4** D) 1/2

- **We are rolling a fair die two times and will consider the product of the two numbers rolled. In this case, there are a total of 36 outcomes in the sample space.**
- **S = {(1,1), (1,2), (1,3), (1,4), (1,5), (1,6), ……, (6,1), (6,2), (6.3), (6,4), (6,5), (6,6)}.**
- **If we express S in terms of the product of the two numbers, we get:**
- **S = {1, 2, 3, 4, 5, 6, 2, 4, 6, 8, 10, 12, 3, 6, 9, 12, 15, 18, 4, 8, 12, 16, 20, 24, 5, 10, 15, 20, 25, 30, 6, 12, 18, 24, 30, 36}.**
- **So, in this case, P(product is odd) = 9/36 = 1/4.**
- **Also, we can produce an odd product if both numbers are odd. If we let E represent the event that number rolled is even, and O represent the event that the number rolled is odd, then the possibilities are: S = {(E, E), (E, O), (O, E), (O, O)}.**
- **So, P(product is odd) = 1/4 (as all outcomes are equally likely).**

8. Suppose that a card is drawn at random from a standard deck of 52 cards. What is the probability that the card belongs to the set {4, 5, 6, 7, 8}?

A) 5/52 B) 5/8 C) 8/13 **D) 5/13**

- **In this case, it doesn't matter what set of 5 face values the set contains. There are 13 different face values in the deck. So the probability of selecting one of the 5 values in the set is simply 5/13.**

9. Three statisticians, each wearing their own hat, go to a party. When they arrive, they each give their hat to the host of the party. After a long night of calculator drills and formula derivations, the statisticians leave the party hastily. As such, the host just "blindly" hands each of the statisticians a hat on their way out. What is the probability that at most one of the statisticians receives their correct hat?

A) 2/3 B) 1/2 **C) 5/6** D) 1/6

- **We can set up a table of possibilities here. Let's assume that a perfect match will occur when A has the correct hat, (A), B has the correct hat, (B), and C has the correct hat, (C) (or sequence A, B, C). We have listed all of the equally likely possible arrangements in the table below. We see that there are 3! = 6 equally likely possible arrangements.**

Sequence	# of Matches
A, B, C	3
A, C, B	1
B, A, C	1
B, C, A	0
C, A, B	0
C, B, A	1

- **From the table, we can see:**
- **P(at most one correct hat) = P(no matches) + P(one match) = 2/6 + 3/6 = 5/6**
- **OR, P(at most one correct hat) = 1 – P(2 or more correct hats) = 1 – P(3 correct hats) = 1 – P(three matches) = 1 - 1/6 = 5/6**

Part 2: Written Answer / Short Answer Questions

Final answers can be left in fraction form OR rounded to THREE DECIMAL PLACES.

For full credit, you need to show all necessary work. Unjustified answers will not receive full credit.

10. A graduating statistics major has signed up for three job interviews. She intends to classify each one as either a "success" (S), or a "failure" (F) depending on whether it leads to a second interview.

a. Based on the above information, using S or F where appropriate, write out the sample space and determine how many outcomes are in the sample space. ***(3 marks)***

- **From the given information, we can write out the sample space as follows:**
- **S = {(S, S, S), (S, S, F), (S, F, S), (F, S, S), (F, F, S), (F, S, F), (S, F, F), (F, F, F)}.**
- **There are a total of 8 outcomes in the sample space.**

b. If we let event A = the second success occurs on the third interview, list the outcomes for the event A. ***(2 marks)***

- **S = {(S, S, S), (S, S, F), (S, F, S), (F, S, S), (F, F, S), (F, S, F), (S, F, F), (F, F, F)}.**
- **The outcomes corresponding to A = second success occurs on the third interview are A = {(S, F, S), (F, S, S)}.**

c. If we assume that all outcomes in the sample space are equally likely, what is P(A)?

(2 marks)

- **We know that there are 8 outcomes in the sample space.**
- **From part b., the outcomes corresponding to A = second success occurs on the third interview are A = {(S, F, S), (F, S, S)}.**
- **If all outcomes in S are equally likely, then P(A) = 2/8 = 1/4**

d. If we let event B = first success never occurs, list the outcomes for the event B.

(2 marks)

- **S = {(S, S, S), (S, S, F), (S, F, S), (F, S, S), (F, F, S), (F, S, F), (S, F, F), (F, F, F)}.**
- **The outcomes corresponding to B = first success never occurs:**
- **B = {(F, F, F)}**

e. If we assume that all outcomes in the sample space are equally likely, what is P(B)?

(2 marks)

- **From part d., the outcomes corresponding to B = the first success never occurs, B = {(F, F, F)}.**
- **If all outcomes in S are equally likely, then P(B) = 1/8 (= 0.125 to 3 d.p.)**

11. You are given information below regarding an apartment building with three floors, containing 1, 2, and 3 bedroom apartments:

	Number of Bedrooms		
	1	**2**	**3**
First floor	2	1	3
Second floor	3	1	5
Third floor	1	5	2

An apartment in this building is selected at random.

a. What is the probability that it is on the second floor? ***(2 marks)***

- **From the given information, we see that there are a total of 23 apartments in this building.**
- **There are a total of 9 apartments on the second floor.**
- **So, P(apartment is on the second floor) = 9/23 = 0.391 (to 3 d.p.)**

b. What is the probability that it has two bedrooms? ***(2 marks)***

- **From the given information, we see that there are a total of 23 apartments in this building.**
- **There are a total of 7 two bedroom apartments in this building.**
- **So, P(two bedroom apartment) = 7/23 = 0.304 (to 3 d.p.)**

c. What is the probability that it is not a three bedroom apartment on the third floor? ***(2 marks)***

- **From the given information, we see that there are a total of 23 apartments in this building.**
- **Of these 23 apartments, there are two three bedroom apartments on the third floor, so P(a three bedroom apartment on the third floor) = 2/23.**
- **This means that P(not being a three bedroom apartment on the third floor) = 1 – 2/23 = 21/23 = 0.913 (to 3 d.p.)**