Assignment #1

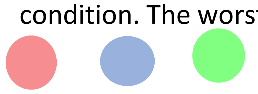
Saturday, August 31, 2019 7:36 PM

Saaif Ahmed

Question #1 (Problem 1.40):
Baniaz and her twins pass a gumball machine with 2 red, 3 blue and 4 green gumballs. Gumballs come out of the machine randomly and cost 1¢ per gumball. All kids must get gumballs of the same color. How much must Baniaz be willing to spend? What if she had quadruplets instead?

(A) How much should she be willing to spend?

The best case scenario is Baniaz gets 2 red consecutively. However we must analyze the worst case condition. The worst case is Baniaz receives 1 red -> 1 blue -> 1 green .



However. Once another gumball is purchased. Any of these present gumballs will be able to form a pair. Therefore the most she would have to spend is 4 ¢.

Answer: 4 ¢

(B) What if she had quadruplets instead?

If Baniaz had to provide for a group of 4, then in this specific scenario Baniaz would have to get all green gumballs, as it is the only set with a quantity greater than 4. As a result the worst case scenario is Baniaz receives everything besides green and then receives the 4 green.
So:
not green -> 4 green.
There are a total of 9 gumballs in the machine which means Baniaz must be able to spend 9¢.

Answer: 9 ¢

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Question #2 Problem (2.5(a)) :

Express the shaded region using unions, intersections and complements.

Answer: The set can be defined as $(A \cap B) \cup (A \cap C)$

Question #3 Problem (2.21 (c)) :

For each case in Problem 2.20, use a variable to give a formal definition of the set of numbers.

(c) $\{0, 1, -2, 3, -4, 5, -6, \ldots\}$

Given in the problem : n= (0, 1, 2, 3, . . .)

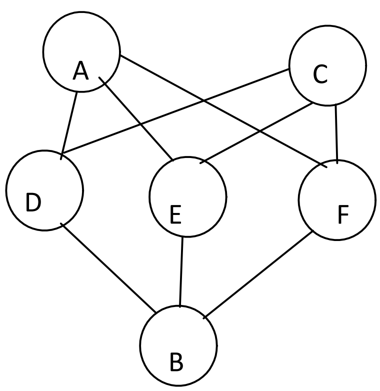
Answer: $s_n = \{n \mid n = n\,(-1^{n+1})\}$

Question #4 Problem (2.22 (c)) :

Draw a picture of each graph representing friendships among our 6 friends V = {A, B, C, D, E, F}.

(c) E = {(A, D),(B, D),(C, D),(A, E),(B, E),(C, E),(A, F),(B, F),(C, F)}.

Answer:



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Question #5 Problem 3.9 :

While growing up, your parents always told you: “If you don’t eat your peas, you can’t have ice-cream.” So, you promptly ate your peas and eagerly awaited your ice-cream. What statement did you imagine you heard, and is that logically equivalent to the statement your parents actually made. Are your parents required to give you ice-cream?

Answer:

Let p = " Do not eat peas"
Let q = " Can't have Ice Cream"

Truth Table for $p \to q$

p	q	$p \to q$	
T	T	T	1
F	T	T	2
T	F	F	3
F	F	T	4

The statement we heard was "If you eat peas then you can have ice cream". This is not logically equivalent to the statement give to us by our parents. To determine whether we are entitled to ice cream we must first have "eaten peas" or $\neg p$ in this case. This means that we must observe the truth table for statements 2 and 4. Here we have $\neg p$ and q is either True or False. This defines ambidguity and we are therefore not guranteed ice cream.

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Question #6 Problem 3.13

Here is a logic puzzle from a psychology experiment studying how humans perform deductive analysis. You have before you the cards (only the top is visible). Each card has a number on one side and a letter on the other.

S	5	P	3	4

Rule: If a card has a P on it, then the other side must be a 5.

To verify that the rule is not been broken, which are the fewest cards that you need to turn over, and why?

Answer:

Let p = "Card Has a P"
Let q = "Other side must be a 5"

Truth Table for $p \to q$

p	q	$p \to q$	
T	T	T	1
F	T	T	2
T	F	F	3
F	F	T	4

For this rule to be true we must prove that scenario 3 can never happen/is impossible. Statement 3 states that if we turn over a P card then the resulting side will not be a 5. To verify the rule we must just turn 1 card over, the only P card in the set.

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Questions #7 Problem 3.23

Given the information, answer the question t, f or I don't know.

(a) If you ace the quiz and final, then you get an A. You aced the final. Did you get an A?

Let p = "Ace quiz"

Let r = "Ace Final"

Let q = "Get an A"

Statement : $(p \wedge r) \rightarrow q$

p	r	q	$(p \wedge r) \rightarrow q$	
T	T	T	T	←
T	T	F	F	
T	F	T	T	
T	F	F	T	
F	T	T	T	←
F	T	F	T	←
F	F	F	T	
F	F	T	T	

The arrows indicate what statements we are going to observe. As shown by the truth table we are do not know if we got an A.

Answer: Do not know

(b) If you ace the quiz or final, then you get an A. You aced the final. Did you get an A?

Let p = "Ace quiz"

Let r = "Ace Final"

Let q = "Get an A"

Statement : $(p \vee r) \rightarrow q$

p	r	q	$(p \vee r) \rightarrow q$	
T	T	T	T	←
T	T	F	F	
T	F	T	T	
T	F	F	F	
F	T	T	T	←
F	T	F	F	
F	F	F	T	
F	F	T	T	

The arrowed statements are the only True statements for this scenario. From the truth table we can deduce that we will indeed get an A.

Answer: Yes

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(c) If you ace the quiz and final, then you get an A. You got an A. Did you ace the final?

Let *p* = "Ace quiz"
Let *r* = "Ace Final"
Let *q* = "Get an A"
Statement : $(p \wedge r) \to q$

p	*r*	*q*	$(p \wedge r) \to q$	
T	T	T	T	←
T	T	F	F	
T	F	T	T	←
T	F	F	T	
F	T	T	T	←
F	T	F	T	
F	F	F	T	
F	F	T	T	←

The arrows represent the statements relevant to the scenario. From the truth table we see there is ambiguity in whether we aced the final.

Answer: Do not know

(d) If you ace the quiz or final, then you get an A. You got an A. Did you ace the final?

Let *p* = "Ace quiz"
Let *r* = "Ace Final"
Let *q* = "Get an A"
Statement : $(p \vee r) \to q$

p	*r*	*q*	$(p \vee r) \to q$	
T	T	T	T	←
T	T	F	F	
T	F	T	T	←
T	F	F	F	
F	T	T	T	←
F	T	F	F	
F	F	F	T	
F	F	T	T	←

The arrows represent the statements relevant to the scenario. From the truth table we see there is ambiguity in whether we aced the final.

Answer: Do not know

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(e) If you ace the quiz and final, then you get an A. You got a B. Did you ace the final?

Let *p* = "Ace quiz"
Let *r* = "Ace Final"
Let *q* = "Get an A"
Statement : $(p \wedge r) \rightarrow q$

p	*r*	*q*	$(p \wedge r) \rightarrow q$	
T	T	T	T	
T	T	F	F	
T	F	T	T	
T	F	F	T	←
F	T	T	T	
F	T	F	T	←
F	F	F	T	←
F	F	T	T	

The arrows represent both valid and relevant truth table values for this situation.
There is ambiguity in the truth table on whether we aced the final.

Answer: Do not know

(f) If you ace the quiz or final, then you get an A. You got a B. Did you ace the final?

Let *p* = "Ace quiz"
Let *r* = "Ace Final"
Let *q* = "Get an A"
Statement : $(p \vee r) \rightarrow q$

p	*r*	*q*	$(p \vee r) \rightarrow q$	
T	T	T	T	
T	T	F	F	
T	F	T	T	
T	F	F	F	
F	T	T	T	
F	T	F	F	
F	F	F	T	←
F	F	T	T	

The arrow represents the only valid and relevant truth table value. If we received a B that means we would have to not get and A on both values. Therefore we did not ace the final.

Answer: No