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MTHSC 4120
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HW #1

Response to "Guidelines for Good Mathematical Writing" by Francis Su

1) What is a good rule of thumb for what you should assume of your audience as you write your homework sets?
   i. We should assume that we are writing to another student who is in the course and has not yet completed the assignment. That student to whom we are writing is also assumed to be on pace in the lecture materials and textbook reading, but we should reiterate recently learned material.
2) Is chalkboard writing formal or informal writing?
   i. It is considered to be informal.
3) Why is the proof by contradiction on page 3 not really a proof by contradiction?
   i. The proof is not considered to be a proof by contradiction because the statement 'Suppose n were not even' is neither contradicted nor even used.
4) Name three things a lazy writer would do that a good writer would not.
   i. A lazy writer would not refine his or her work after completing the first draft and noticing either errors or suboptimal information.
   ii. A lazy writer would not properly punctuate his or her mathematical writing.
   iii. A lazy writer would employ shorthand in formal writing.
5) What's the difference in meaning between these three phrases?
   "Let A = 12", "So A= 12", " A = 12"
   i. The three phrases differ in their implications. "Let" suggests a condition that is being established, "So" denotes a result, and a lack of preface in the third example indicates an absolute.

VGT Exercises

1.2 In this situation, we have three coins (a nickel, penny, and dime) sitting on a desk. The only action is to swap the places of the penny and the nickel. To qualify as a group, the situation must satisfy the following rules of symmetry: there exists a predefined list of actions that never changes, every action is reversible, every action is deterministic, and any sequence of consecutive actions is also an action.

I believe that this still qualifies as a group because the existence of the dime in situation is, as I understand it, irrelevant. There is still a predefined list of actions (swapping the places of the penny and the nickel) and the available action doesn't change. Every action is reversible, because once you swap the places of the penny and the nickel, swapping them again undoes the original action. It is deterministic because the outcome of an action is not dependent upon probability. And any sequence of actions is possible, because swapping the penny and nickel maybe repeated indefinitely and the existence of the dime does not interfere with this. Thus, the situation qualifies as a group.

1.8 a.) In a Rubik's cube group, the order of the actions affects the outcome.

b.) The situation in which the only action is the swapping of places of two identical items.

c.) A group in which the following moves are actions: a vertical flip, a horizontal flip, vertical horizontal, and the do nothing action.

d.) A group in which the following moves are actions: a vertical flip, a horizontal flip, a quarter turn rotation, consecutive actions, and the do nothing action.

e.) A group in which taking *n* steps is an action.

1.9 There are n! actions in this group because of rule 18, so there is no way to get a group with 4 actions.

1.10 If we consider the following situation: we have an infinite pile of potato chips and the only available action is to eat a chip then all conditions of a group are satisfied except the reversibility condition. This is true because we have a predefined list of actions that never changes (eat a chip), eating a chip is deterministic (does not rely on chance to succeed) and we can (theoretically) eat an infinite amount of chips (that is, every sequence of actions is also an action. The only thing that is not satisfied is the reversibility clause because once you eat the chip, it ceases to exist in that state; you cannot un-eat a chip and have it be in the same form.

1.11 The situation in which an action is based on a probability (say a coin flip) would violate the deterministic clause. For example, if we have two infinite piles of balls and our only action is to move a ball from one pile to another if we get a heads on a coin toss. Then, while there is a predefined and immutable list of actions, every action is reversible, and any sequence of actions is also an action, the action is not deterministic. We may very well intend to move a ball but be unable to because we drew a tails on the coin toss.

1.12 This rule is broken in situations in which an action may be performed a limited number of times. For example, say we are in an 8'x8' room and your available actions are to walk forward a foot, turn around and walk backwards a foot, and turn right and walk forward a foot. While there is a predefined and immutable list of actions, every action is reversible, and every action is deterministic, any sequence of actions is not guaranteed to be an action as well. We could not, for example, walk 9 feet forward because the room is only 8 feet long.

1.13 In this situation, we do have a group. There is a predefined list of actions (add any whole number to the original whole number), every action is reversible (add the negative of the previously added whole number), every action is deterministic (it doesn't rely on probability), and any sequence of actions is also an action (adding *n* whole numbers together results in a new whole number). The smallest set of generators would be -1 and 1, because from these you can make any whole number.