Homework in Math 128A
Fall 2020

Expectations. To do as well as you are capable of doing in Math 128A, you should expect to do **at least:**

13–15 hours of work each week outside of class.

Proof homework. In many homework problems, you will be asked to "Prove..." or "Show that..." or "Explain why..." something is true. In these problems, the point is basically to give a logical explanation in complete sentences, i.e., a *proof*. For more details, see the handout on writing proofs, downloadable from the course webpage.

You will have several chances to work on, and revise, all homework problems. Specifically, this process has 3 steps: outline, submission, and revision.

1. An outline of each problem set will be due in the class before the completed version is due, and will be discussed briefly in that class. For example, the outline for problem set 01 is due **Mon Aug 24**. In that class, and in the problem session the Friday before, we will spend a few minutes discussing that outline and what PS01 is asking you to do.

   In each outline, you should do the following:

   (a) **Write down the definitions of all important new terms in the problem set** (e.g., group, subgroup, coset). The point is to show that you understand what each problem in the problem set is asking.

   You do not need to repeat definitions that have appeared before, just new ones. Also, **please do not write out the theorems** involved in each problem set.

   (b) **Write down a plan for every problem.** The way you do this depends on the problem. (In particular, you need to do enough work on a problem to tell what methods are needed!) See the handout on proof for more about definitions, theorems, assumptions, conclusions, and different methods of proof.

      - If the problem is a computation, just note what needs to be computed (what form should the final answer take?).
      - If the problem is an "if-then" proof, write down what you are **assuming** in your proof, and write down the **conclusion** you are trying to reach.
      - If the problem involves proving that "There exists (blah blah)", write down the name of the object that you need to construct, and write down an assume-conclude structure for the properties that the constructed object needs to have.
      - If the problem involves proof by contradiction, write down the initial assumptions that you hope will lead to a contradiction.
      - If the problem involves proof by induction, write down an outline for the base case of the induction (usually either "there exists" or "if-then"), and then write down an assume-conclude pair for the induction step.

   See below for some examples in the sample partial outline for PS01.

   Late outlines will not be accepted, but to allow for illness, etc., your lowest outline grade will be dropped.

2. Submit the completed version. (For PS01, this will be on **Wed Aug 26**.) You do not need to include your outline with the completed version.

3. After you get the graded problem set back, you have as many chances as you want to revise the problems as much as you like, usually until the class before the next in-class exam. (For example, the last chance to revise PS01 is **Wed Sep 16**.) Each time you submit a revision,

please attach the original completed version and all previous revisions, so I know how many points to add on to your score. (Please arrange the versions with the **newest on the top**, down to the original version on the bottom.) You do not need to revise/rewrite problems that you have previously gotten correct; just correct the ones you got wrong.

Revising missed problem sets: It is possible to "revise" a problem set that is not turned in on the due date. However, each time you miss a due date, all previous homework from missed due dates becomes unrevisable. Note that "missing" a due date can also include turning a homework that, in my judgment, does not represent a sufficient effort to continue with the course. (I'll let you know quite clearly that your effort is insufficient if it happens.)

Rules for working together: The basic rule about working together is that you are encouraged to talk to each other about homework, as everyone learns from such discussion, but you are not allowed to copy solutions. Please also do not let others "borrow" or make xeroxes of your homework.

COPYING IS CHEATING: *COPYING ANSWERS FROM OUTSIDE SOURCES IS ALWAYS CHEATING.* This includes, but is not limited to, copying from tutors, copying from other textbooks, copying from the Internet, and getting answers online, and is not just true for exams, but also for homework.

Homework copying will result in a grade of 0 both for the person copying and the person being copied from. After repeated offenses, I will file a report of academic dishonesty with SJSU.

There may be times this semester when you feel like you are struggling with the homework in this class. *That struggle is part of the point of the homework.* One of the best ways, and maybe the only effective way, to learn a creative subject like abstract algebra is to struggle with the ideas and problems. That's one of the main reasons I don't want you to copy answers, even on homework — that kind of cheating deprives you of an important opportunity to learn.

Consequences: Homework copying will, in general, result in a grade of 0 both for the person copying and the person being copied from. After repeated offenses, I will file a report of academic dishonesty with the university. Offenses on exams will result in my filing a report with the university, and may result in your immediate failure of the class.

How to do an outline (examples)

The outline for PS01 should go basically as follows.

Relevant definitions: Please collect all relevant new definitions at the beginning of your outline. For example:

Defn. We say that an integer a *divides* an integer b if (etc.)

Defn. An *equivalence relation* on a set S is (etc.)

Defn. We say that a group G is *abelian* if (etc.)

There are many definitions covered in the material for PS01, but since much of Ch. 0 will be review for many of you, for this outline only, you will only need to list the new definitions from Ch. 1. For reference, the key definitions in Ch. 0 are: divisor/divides, prime, multiple, quotient, remainder, greatest common divisor/$gcd(a, b)$, relatively prime, least common multiple/$lcm(a, b)$, equivalence relation, partition, function, range, domain, image, composition, one-to-one, onto.

Notes for each problem. This will vary slightly from problem to problem. Again, the different types of proof and their corresponding outline styles are:

- *"If-then" proof:* Write down your assumption and your conclusion.

- *"There exists..." proof:* Name of the object you need to construct, assume-conclude structure for the properties of that object.

- *Proof by contradiction:* (rare) State initial assumptions that will lead to a contradiction.

- *Induction:* (very rare) Outline for the base case; assume-conclude pair for the induction step.

Examples:

Computation: (Ch. 1, prob. 24) Final answer is list of symmetry groups for designs, each either D_n or C_n (cyclic rotation group of order n).

If-then: (PS01, 2a)

Assume: a, b, t integers, t divides a, t divides b.

Conclude: t divides $a + b$.

There exists: (PS01, 3) A first attempt might be:

Assume: a, b, s, t integers, $s, t > 0$, $\gcd(s, t) = 1$.

Conclude: There exists some integer n such that $n = a \pmod{s}$ and $n = b \pmod{t}$.

A better outline would be:

Assume: a, b, s, t integers, $s, t > 0$, $\gcd(s, t) = 1$.

(Some method or algorithm for finding n)

Conclude: $n = a \pmod{s}$ and $n = b \pmod{t}$.