Course Objectives and Problems
Math 52 — Spring 2023— Dupuy

WARNING: Prior to being assigned a quiz date, homework problems are subject to change.

Propositions

1. I understand truth tables (§1.1: 1a, 1c, 2b, 2d, 2e)
2. I understand how to read logic and convert to english (§1.1: 7, 12, 15)
3. I understand how to use basic properties of the integers to prove things. (§1.2: 1,2,3,4, §2.1: 1)
4. I understand summation notation, can state and prove the geometric sum formula, and can state and prove the difference of powers formulas. (The quiz is going to ask you to state and prove the geometric sum formula).

Proofs

1. I understand direct proof techniques
   (a) I understand counter-examples
   (b) I understand how to prove existential statements:
   (c) I understand the basic concepts surrounding the integers.
   (d) I understand basic properties of real numbers and how to use them in proofs.
   (e) I understand proofs by cases
   (f) I understand how to proof biconditional statements
   (g) I understand what uniqueness is and how to use it and how to prove it

   (§2.1: 3, 5a-i, 7, 15, 17, 21)
2. I understand indirect proof techniques
   (a) I know how to prove a conditional statement.
   (b) I know how to use a conjunctive hypothesis.
   (c) I know how to use an existential hypothesis.
   (d) I know how to use a universal hypothesis.
   (e) I know how to use a contrapositive in a proof.

   (§2.2: 1,2,3, 6a, 6b, 7, 8, 9, 10, 12 (use a difference of powers), 13)
3. I know how to give a proof by contradiction (§2.3: 1,2,3,4)

Induction

1. I know how to do proofs by weak induction. (§3.1: 2,3,4,8,9,11,12,15,16)
2. I know how to prove the binomial theorem (§3.1: 18,19)
3. I know how to do proofs by strong induction. (§3.2: 1, 2)
4. I can prove the fundamental theorem of arithmetic.

Sets

1. I understand the different notations for sets. (§4.1: 1a-k)
2. I understand how to prove something is or is not an element of a set.
3. I know how to work with the empty set.
4. I now how to show one set is a subset of another.
5. I know how to show two sets are equal (§4.1: 5, 6)

6. I understand the basic set operations (intersection, union, complement) (§4.2: 1a-i, 2, 3, 5, 8, 11*, 12, 15, 16, 17, 22, 23, 24)
7. I understand indexed families of sets and how to work with them. (§4.2: 1,3,5,6,9)

Functions

1. I understand functoins, domains, codomains, images, and preimages. (§5.1: 1, 2, 4, 5, 7)
2. I understand injectivity, surjectivity, and bijectivity (§5.3: 1, 2, 7; §5.4: 1a-o, 10).
3. I understand function composition. (§5.2: 1, 4)
4. I understand functions on sets (§5.5: 2,3,4,8,10,11)

Arithmetic

1. I understand the well-ordering principal and I can use it in a proof. (§6.1:)
2. I understand the division algorithm and can use it in a proof by cases.(§6.1: 3)

Relations and Equivalence Classes This will be a jumble of §6.4, §6.5, §7.1, §7.2, §7.3

1. I understand what a relation is.
2. I understand reflexivity, transitivity, and symmetry of relations.
3. I understand what a quotient set it and what a quotient map is.
4. I understand what it means for a function to be well-defined.
5. I understand modular arithmetic.

Cardinality The following covers §8.1, §8.2, §8.3, §8.4

1. I know the difference between a finite and infinite set.
2. I know the difference between a countable and uncountable set.
3. I know the basic examples of countable and uncountable sets.