Metropolitan State University

ICS 372 HW3 **Chord Finder**

Background

Most Western music is based on the chromatic scale: a series of 12 pitches, represented as notes, each a semitone apart. Notes are named with the letters A-G. Some notes are named just a letter, while some have a suffix called an "accidental" meaning a semitone above or below the note with the letter-name.

Starting from A, the 12 tones can be named

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
With #'s	A	A#	B	C	C#	D	D#	E	F	F#	G	G#
With *b*'s	A	B*b*	B	C	D*b*	D	E*b*	E	F	G*b*	G	A*b*
Other names			C*b*	B#				F*b*	E#			

The difference between two successive notes is called a half-step. The order of notes is cyclic. That is, the note one half-step higher than G#/Ab is again A, and the note one half-step lower than A is Ab/G#. Notes that are a multiple of 12 half-steps apart have the same name, and for our purposes we will consider them equivalent.

Each pitch may have multiple names: A# is the same as Bb, C# is the same as Db, etc. The alternate names of a pitch is called an *enharmonic.*

Intervals

The distance between two notes is called an *interval*. The names of the intervals are:

Distance in Half-Steps	Name of Interval
0	Perfect unison
1	Minor second
2	Major second
3	Minor third
4	Major third
5	Perfect fourth
6	Diminished fifth
7	Perfect fifth
8	Augmented fifth
9	Major sixth
10	Minor seventh
11	Major seventh

Chords

A chord in music is made of three or more notes that is heard as if sounding simultaneously. A three-note chord, called a triad is named made from a 7-note subset of the chromatic scale, called the diatonic scale. Each note is mapped to each of the letters A-G with potentially an accidental.

Chord Spelling

Chords are “spelled” by identifying the notes. For example

1. G B D
2. C Eb G
3. B D# G

Note: (no pun intended) the note might not be in order, that is, the first note might not be the root of the chord.

Chord Quality

The chord quality is determined by the interval between the root and the third note of the diatonic scale. When the third is 4 semi-tones from the root, it's a *major* chord; if it is 3 semi-tones, it is a *minor* chord.

The Altered 5th

The distance between the root and the fifth note of the diatonic scale is normally 7 semi-tones from the root. If the fifth is a semi-tone higher the chord is *augmented*, if a semi-tone lower, it is *diminished*.

Chord Name

A chord is named based on

1. The root note (e.g. “C”)
2. The chord quality (e.g. major or minor).
3. The alteration of fifth note of the diatonic scale (e.g. diminished or augmented).

The chord name can be determined two ways:

- Method 1: by measuring the interval between the root and third, and then the interval between the third and fifth or,
- Method 2: by measuring the interval between the root and third, then the interval between the root and the fifth.

Method 1			**Method 2**	
Root-->Third	**Third-->Fifth**	**Chord Name**	**Root-->Third**	**Root-->Fifth**
Major third	Minor third	**Major (“maj”)**	Major third	Perfect fifth
Minor third	Major third	**Minor (“min”)**	Minor third	Perfect fifth
Major third	Major third	**Augmented (“aug”)**	Major third	Augmented fifth
Minor third	Minor third	**Diminished (“dim”)**	Minor third	Diminished fifth

ASSIGNMENT

Implement a class ChordFinder that takes as an input three strings representing notes and returns asset of Strings of recognized chord names they can represent, or an empty set if no chords are recognized.

Examples

["D”, “G”, “ B"] (Using method 1)

- Root : G
- Interval G-->B : major third
- Interval B-->D: minor third
- Chord Name(s): [“G maj”]

[“C”. “Eb”, “G”] :(Using method 2)

- Root: C
- Interval C--> Eb : minor third
- Interval C--> G : perfect fifth
- Chord Name(s) [“C min”]

[“B”, “D#”, “G”]

- Roots : B, D#, or G
- Intervals (B—>D#, D#-->G, and G-->B) : major third
- Intervals (B-->G , D#-->B, G-->D#) : augmented fifth
- Chord Names: [“B aug”, “D# aug”, “G aug”]

Definition

Class:	ChordFinder
Method:	getChordName(String … note)
Parameters:	note - 3 notes of chord, separated by a space
Returns:	Set<String> -- set of chord names if recognized, or empty list if not recognized
Method signature:	Set<String> getChordName(String … note)

(be sure your method is public)

Input

- Valid input must have exactly three discrete notes
  - Accidentals will use “#” for sharp and “b” for flats.
  - too many or too few notes should throw an IllegalArgumentException
  - an invalid note, e.g. “Zb”, program should throw an IllegalArgumentException
  - An unrecognized chord should return an empty list.

Output

- A Set<String> containing the names of possible chords names of the given notes
  - The format must be <Note> <name> where
    - <Note> is the root note, “A” – “G” optionally followed by a “b” or “#” representing a sharp or flat respectively. The note must be upper-case
    - a space
    - <name> is one of “maj”,“min”,“aug”,“dim”; the name must be lower case

Notes

Project Name: group*n*_HW3_ChordFinder

Package Name: group*n*.hw3.chordfinder

- Where **group*n*** represents your "group id": consisting of
  - Last digit value of your D2L "Group ID" (e.g: G1_6782148_3125030_**0** would be "**group0**")
- Enharmonic names are acceptable, e.g. B# Fb G is B# maj (same as C maj)
- Programs will be tested strictly with JUnit tests. You may create a main method and generate output, but they are not required.
- Be sure to have a comment at the top of each class you implement with your name
- Provide Javadoc for all public methods
- Demonstrate how you have tested your submission
  - JUnit not required, but highly recommended.
  - Show test cases that show completeness
- Also be sure to include the following in a docs directory in your src/main/resources folder:
  - Domain Model
  - Use case diagram/scenario
  - Robustness Model.

  Note: *make them either pdf or Word documents, or png files. Do not add a .drawio file.*