Papaw Hmong Writing System (Unicode 7.0 Range: 16B00-16B8F)

(http://unicode.org/charts/PDF/U16B00.pdf)

Base Characters:

(Base 1): 𖬀 𖬁 𖬂 𖬃 𖬄 𖬅 𖬆 𖬇 𖬈 𖬉 𖬊 𖬋 𖬌 𖬍 𖬎 𖬏 𖬐 𖬑 𖬒 𖬓 𖬔 𖬕 𖬖 𖬗

(Base 2): 𖬛 𖬜 𖬝 𖬞 𖬟 𖬠 𖬡 𖬢 𖬣 𖬤 𖬥 𖬦 𖬧 𖬨 𖬩 𖬪 𖬫 𖬬 𖬭 𖬮 𖬯

Diacritics (Combining Marks):

◌𖬰 (U+16B30, PAHAWH HMONG MARK CIM TUB)

◌𖬶 (U+16B36, PAHAWH HMONG MARK CIM TAUM)

◌𖬵 (U+16B35, PAHAWH HMONG MARK CIM HOM)

◌𖬲 (U+16B32, PAHAWH HMONG MARK CIM KES)

The purpose of this project is to design or use an opentype shaping engine such as Harfbuzz to position the diacritics (u+16b30, u+16b36, u+16b35, u+16b32) onto their correct position relative to a base character. Each mark shall be placed at precisely centered above each base glyph as shown in the below example:

Task 1 of OpenType Shaping Engine (Mark-to-Base Positioning):

The shaping engine need to be able to obtain the mark-to-base feature from the font and display the correct image onto the screen.

𖬀𖬰 𖬁𖬰 𖬂𖬰 𖬃𖬰 𖬄𖬰 𖬅𖬰 𖬆𖬰 𖬇𖬰 𖬈𖬰 𖬉𖬰 𖬊𖬰 𖬋𖬰 𖬌𖬰 𖬍𖬰 𖬎𖬰 𖬏𖬰 𖬐𖬰 𖬑𖬰 𖬒𖬰 𖬓𖬰 𖬔𖬰 𖬕𖬰 𖬖𖬰 𖬗𖬰

𖬀𖬶 𖬁𖬶 𖬂𖬶 𖬃𖬶 𖬄𖬶 𖬅𖬶 𖬆𖬶 𖬇𖬶 𖬈𖬶 𖬉𖬶 𖬊𖬶 𖬋𖬶 𖬌𖬶 𖬍𖬶 𖬎𖬶 𖬏𖬶 𖬐𖬶 𖬑𖬶 𖬒𖬶 𖬓𖬶 𖬔𖬶 𖬕𖬶 𖬖𖬶 𖬗𖬶

𖬀𖬵 𖬁𖬵 𖬂𖬵 𖬃𖬵 𖬄𖬵 𖬅𖬵 𖬆𖬵 𖬇𖬵 𖬈𖬵 𖬉𖬵 𖬊𖬵 𖬋𖬵 𖬌𖬵 𖬍𖬵 𖬎𖬵 𖬏𖬵 𖬐𖬵 𖬑𖬵 𖬒𖬵 𖬓𖬵 𖬔𖬵 𖬕𖬵 𖬖𖬵 𖬗𖬵

𖬀𖬲 𖬁𖬲 𖬂𖬲 𖬃𖬲 𖬄𖬲 𖬅𖬲 𖬆𖬲 𖬇𖬲 𖬈𖬲 𖬉𖬲 𖬊𖬲 𖬋𖬲 𖬌𖬲 𖬍𖬲 𖬎𖬲 𖬏𖬲 𖬐𖬲 𖬑𖬲 𖬒𖬲 𖬓𖬲 𖬔𖬲 𖬕𖬲 𖬖𖬲 𖬗𖬲

ᦞ ᦟ ᦠ ᦡ ᦢ ᦣ ᦤ ᦥ ᦦ ᦧ ᦨ ᦩ ᦪ ᦫ ᦬ ᦭ ᦮ ᦯ ᦰ ᦱ ᦲ ᦳ ᦴ ᦵ ᦶ ᦷ ᦸ ᦹ ᦺ ᦻ ᦼ ᦽ ᦾ ᦿ

As you can see the red glyphs did not display correctly (even with OpenType feature (using Microsoft VOLT application).

Task 2 of OpenType Shaping Engine (Displaying Invalid Combination):

If a base character and a diacritic mark is combining then check to see if they are a valid combination, if not, display the U+25CC (dotted circle) with the diacritics (above the dotted circle as stated in the Unicode Standard).

Examples:

(Below are the invalid combinations)

1. Any Base 1 character (see above) + ◌ᭆ (U+16B35) is automatically invalid, therefore the output should be the original Base 1 character follow by the dotted circle with the diacritics above:

   Base_1_character_member + ᭆ = Base_1_character_member + ◌ᭆ

   Concrete Examples: (“+” means follow by)

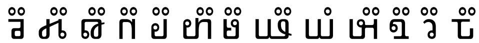
   ᦒ + ᭆ = ᦒ◌ᭆ ᦓ + ᭆ = ᦓ◌ᭆ ᦔ + ᭆ = ᦔ◌ᭆ

   ᦕ + ᭆ = ᦕ◌ᭆ ᦖ + ᭆ = ᦖ◌ᭆ

2. Any Base 2 character (see above) + ◌ᭅ (U+16B32) OR ◌᭶ (U+16B36) is automatically invalid, therefore the output should be the original Base 2 character follow by the dotted circle with the diacritics above:

   Base_2_character_member + ᭅ = Base_1_character_member + ◌ᭅ
   Base_2_character_member + ᭶ = Base_1_character_member + ◌᭶

3. Go through the set of Base 1 and remove all other invalid combinations. Since this set is finite, we can list the remaining invalid combinations:



Task 1 and Task 2 are the most important OpenType features for the Pahawh Hmong Script.

My first attempt:

I used Microsoft VOLT program to position the marks (Mark-to-Base feature), compile the program and test the glyphs in VOLT and they did displayed correctly. But when I produce and install the .otf font and test the font in word processing applications such as MS Word 2013 and LibreOffice Writer, there were no effects (no opentype features, no mark to base positioning). Then I tested the font using Firefox browser (email, websites, etc.). To my surprise there were opentype features automatically and each base glyph + diacritics did produce the correct result.

After researching I realized that Firefox uses Harfbuzz. So I needed a similar engine in order for my writing system to display correctly. Right now my main focus is to make my script works on the Web (Chrome, Opera, and Internet Explorer) and in Word Processors such as MS Word and LibreOffice Writer.

Questions:

- How do I link my source file to the libraries or header files in Harfbuzz? (I am using Windows 7 to create this project, but if necessary I can use Ubuntu if it’s easier to setup).
- How do I link my font to the program using Harfbuzz so that it knows how to apply the opentype shaping engine to produce the desire glyph?

- After creating my font and using Harfbuzz, will my font be able to display correctly in MS Word/LibreOffice Writer and the Web?

Please provide me with sample codes on using Harfbuzz to accomplish Task 1 and Task 2. I know how to program in C/C++ but I am a beginner when comes to OpenType Shaping engine so can you provide me with a step-by-step procedure? Once I get a successful first run then I will add in more features later.