Racing The Beam

Sunday, January 16, 2011

Sega Master System Tile Format

The Color Palette
The Sega Master System has a 6-bit RGB palette (64 colors); The VDP however, only has enough color ram to store 32 colors. The first sixteen colors are designated as the background palette and the following sixteen are the sprite palette. The VDP color format is defined as xxbbggrr where xx is unused and rr, gg and bb represent the intensity of red, green and blue.

The SMS Tile Format
Each pixel in a tile is an index into a color palette. This requires four bits to index the palette as colors 0 - 15(0b0000 - 0b1111). Thus, every 8 x 8 tile will require 32 bytes of storage. Each row of 8 pixels is organized as a four byte group where the first byte contains bit 0 of each pixel, the second contains bit 1 of each pixel and so on.

Examples:
One row of an 8x8 tile using color 5(0b00000101)
Byte 1: 0b11111111
Byte 2: 0b00000000
Byte 3: 0b11111111
Byte 4: 0b00000000

One row of an 8x8 tile using color 11(0b00001011)
Byte 1: 0b11111111
Byte 2: 0b11111111
Byte 3: 0b00000000
Byte 4: 0b11111111

Converting to SMS Formats:

Color Conversion
To convert a 24 bit per pixel color to 6 bit per pixel colors we can simply use the two most significant bits of each color component. A small snippet of python below shows an easy way to perform this task. We use a bitwise AND to clear all but the two most significant bits of each color and apply a few bit shifts to position those two bits into positions defined by the sms color format(xxbbggrr).

```
"""
Converts a 24bit per pixel color to 6 bit per pixel.
Inputs: rgb_val  - A 24 bit color in format bbbbbbbbggggggggrrrrrrrr
Outputs:  6 bit per color representation of input in format xxbbggrr
"""
def Convert24bppTo6bpp(rgb_val):
    red = (rgb_val & 0xc0)
    green= ((rgb_val >> 0x08)  & 0xc0)
    blue= ((rgb_val >> 0x10) & 0xc0)

    return (red >> 0x06) | (green >> 0x04) | (blue >> 0x02)
```

Tile Conversion

To convert a tile from a format where the four-bit palette indexes are stored sequentially as 8 bytes into to the sms format we will take the least significant bit of each pallet index and store these as the first byte, the next significant bit as the second byte and so on.

About Me

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"""
Converts a single row(8 pixels) of a tile into sms format.
Inputs: pixels - a list of 8 4 bit palette indexes where the first list item contains palette index for pixel 7, the second for pixel 6 etc.
Outputs: List of four bytes where the first byte contains bit 0 of each pixel, the second contains bit 1 of each pixel and so on.
"""

```
def ConvertRow(pixels):
    out = []
    for i in range(4):
        out_byte = 0
        for j in range(8):
            out_byte += ((pixels[7-j] >> i) & 0x1) << j
        out.append( out_byte )

    return out
```

Posted by Dave at 4:30 PM

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