Teacher Notes for *Binary, Hexadecimal Conversions*:

Lesson Objective: Students will convert whole number quantities between base 10, binary, and hexadecimal number systems.

Length of Activity: One day (approximately 50 minutes)

AP Topics:
III. Program Analysis
F. Numerical representation of integers
1. Representations of non-negative integers in different bases

Materials: ** jar file links go here*

Suggested Lesson Activity: Students will be working on paper today and will need access to notebooks or at least scratch paper. Do not let them linger while copying the information from the tables to their papers. You will need to make copies of the Bin_Hex_Assignment.pdf but do not distribute it until the whole class has completed **Read, Discuss, and Answer, part 11 bin.**

Read, Discuss, and Answer, part 1 bin:

ANSWERS:

5(10^2) + 2(10^1) + 1(10^0)	= 521
3(10^1) + 2(10^0)	= **[32]**
[1(10^2) + 0(10^1) + 7(10^0)]	= 107
[8(10^2) + 6(10^1) + 1(10^0)]	= 861
4(10^2) + 0(10^1) + 2(10^0)	= **[402]**
6(10^3) + 8(10^2) + 2(10^1) + 9(10^0)	=**[6829]**
[7(10^3) + 9(10^2) + 5(10^1) + 7(10^0)]	= 7957

Read, Discuss, and Answer, part 10 bin:

ANSWERS:

Exponential Expression	Bin	Dec
1(2^2) + 1(2^1) + 0(2^0)	= 110	= 6
1(2^3) + 0(2^2) + 1(2^1) + 1(2^0)	= **[1011]**	= 11
[1(2^3) + 1(2^2) + 0(2^1) + 0(2^0)]	= 1100	= 12
[1(2^3) + 0(2^2) + 0(2^1) + 1(2^0)]	= **[1001]**	= 9
1(2^4) + 0(2^3) + 1(2^2) + 1(2^1) + 1(2^0)	=**[10111]**	=**[23]**
[1(2^4) + 1(2^3) + 0(2^2) + 1(2^1) + 0(2^0)]	= 11010	=**[26]**
[1(2^4) + 1(2^3) + 0(2^2) + 0(2^1) + 1(2^0)]	=**[11001]**	= 25

Read, Discuss, and Answer, part 11 bin:

One way to see an example of a hexadecimal is to call a `toString()` method on an object that does not have one. *(technically: does not provide an override of the Object object toString())*. The returned `String` will include a memory location in hexadecimal form.

ANSWERS:

Exponential Expression	Hex	Dec
5(16^1) + 11(16^0)	= 5b	= 91
1(16^1) + 13(16^0)	= **[1d]**	= 29
14(16^1) + 3(16^0)]	= e3	= 227
7(16^1) + 15(16^0)]	= **[7f]**	= 127
11(16^2) + 2(16^1) + 5(16^0)	= **[b25]**	=**[2853]**
10(16^2) + 1(16^1) + 2(16^0)]	= a12	=**[2578]**

Circulate and check the work of the student pairs. To allow you to control the pacing and keep the class together the remainder of the lesson is in a separate pdf document . You may wish to print or distribute the Bin_Hex_Assignment when the class has finished part `11 bin` together.

The problem generator is also an excellent resource for additional practice problems.

Bin_Hex_Assignment.pdf:

ANSWERS:

Multiple Choice:

1) a. 58 1(2^5) + 1(2^4) + 1(2^3) + 0(2^2) + 1(2^1) + 0(2^0) = 58

2) e. 114 7(16^1) + 2(16^0) = 114

3) d. 8b 8(16^1) + 11(16^0) = 139

4) d. 111111 1(2^5) + 1(2^4) + 1(2^3) + 1(2^2) + 1(2^1) + 1(2^0) = 63

5) a. 110111 1(2^5) + 1(2^4) + 0(2^3) + 1(2^2) + 1(2^1) + 1(2^0) = 55

6) b. 188 11(16^1) + 12(16^0) = 188

7) d. 6a 6(16^1) + 10(16^0) = 106

8) e. 53 1(2^5) + 1(2^4) + 0(2^3) + 1(2^2) + 0(2^1) + 1(2^0) = 53

9) c. 87 8(16^1) + 7(16^0) = 135

10) e. 101100 1(2^5) + 0(2^4) + 1(2^3) + 1(2^2) + 0(2^1) + 0(2^0) = 44

Free Response:

1) 203 12(16^1) + 11(16^0) = 203

2) 50 1(2^5) + 1(2^4) + 0(2^3) + 0(2^2) + 1(2^1) + 0(2^0) = 50

3) 58 5(16^1) + 8(16^0) = 88

4) 110000 1(2^5) + 1(2^4) + 0(2^3) + 0(2^2) + 0(2^1) + 0(2^0) = 48

5) 138 8(16^1) + 10(16^0) = 138

6) 6d 6(16^1) + 13(16^0) = 109