Lab 7: The sin Function

- **Due date**: By the end of Thursday, 10/24/2019.
- Lab worth 10 points.
- Individual submission.

Description

In this lab, you implement the single-precision version of the `sin` function with MIPS assembly code. The skills you practice in this lab includes MIPS coding and MIPS floating point instructions.

Implement the `sin` function. The `sin` function takes a single-precision floating-point (FP) number x as input and computes sin(x). The interface of the function looks like:

```
float sin(float x);
```

You will use Taylor series to compute sin and the formula is shown below. You can also study the C implementation on the next page.

$$\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \frac{x^9}{9!} + \cdots$$

The main function computes and prints the sine of all single precision numbers stored in array `arr`. The skeleton code has a loop that uses a pointer ($s0) to access every element in the array. You **must complete the loop** with following tasks: load a single-precision FP number x from the address in $s0, compute sin($x$), and print sin($x$).

Please follow the MIPS calling conventions. Recall that x is passed to the `sin` function in $f12, and the returned floating-point number is in $f0.

Add brief comments to explain your code.

Deliverables

Submit revised lab7.s, which has your code and comments, in HuskyCT.

To receive full credits, your code should use proper MIPS instructions/pseudoinstructions.

```
/* The function computes sin(x), where x is a float. */
float sin(float x)
{
	/* define local variables. */
	int    i;
	float  fact, power, n, v, sign;

	sign = 1.0;  /* 1.0 or -1.0 */
	n = 1.0;     /* to compute factorial */
	fact = 1.0;  /* factorial of n */
	power = x;   /* power of x */
	v = x;       /* sin(x) */
	for (i = 0; i < 20; i ++) {
		power *= x * x;                  /* update the power of x */
		fact *= (n + 1.0) * (n + 2.0);   /* update the factorial */
		n += 2.0;
		sign = - sign;                   /* update the sign */
		v += power / fact * sign;
	}
	return v;
}
```

Below is a sample session of running the code.

```
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0.099833414
0.19866934
0.29552022
0.38941833
0.47942552
0.7071067
0.99999994
-1.083978E-8
0.0
```