Report: Project 5 Challenge 1.0

Interest Calculations

1. Reward Calculation

- The calculation of accumulated rewards for 2025 is simply the sum of each of the respective categories multiplied by the percentage for that category.
- Groceries $7200 * .03 = $216, Gas $1200 * .02 = $24 , Other $3600 * .01 = $36
- The Carl's total rewards for 2025 are $276.

2. Simple Interest Calculation

- While not accurate, as interest is normally calculated with a daily average balance, you can make a rough estimate of the interest Carl pays for 2025. This is simply the annual interest rate divided by the number of months and then multiplied by the revolving balance. This amount is then compounded onto the previous balance for the next months calculation.
- 35% Annually is 2.92% monthly.
    - January interest and ending balance: $29.20 and $1029.20
    - February interest and ending balance: $30.05 and $1059.25
    - March interest and ending balance: $30.93 and $1090.18
    - April interest and ending balance: $31.83 and $1122.02
    - May interest and ending balance: $32.76 and $1154.78
    - June interest and ending balance: $33.72 and $1188.50
    - July interest and ending balance: $34.70 and $1223.20
    - August interest and ending balance: $35.72 and $1258.92
    - September interest and ending balance: $36.76 and $1295.68
    - October interest and ending balance: $37.83 and $1333.51
    - November interest and ending balance: $38.94 and $1372.45
    - December interest and ending balance: $40.08 and $1412.53
- The total accrued interest for 2025 is **$412.53**, this is considerably higher than the *$350 that someone could reasonably expect 35% interest to be*. This is due to the compounding interest.

3. Average Daily Balance Calculation

3.1. Daily Periodic Rate

- DPR = APR/360 (use of 360 as per project instructions)
  - DPR = .35/360 (use of 360 as per project instructions)
  - DPR = .000973

3.2. Average Daily Balance Compounding at the End of the Billing Cycle

Annual Interest Rate	35%
Daily Interest Rate	0.000972222

$1000 charged on the 15th of the month
$1000 paid on the 20th of the month
Interest compounded on the 30th of each month

	1st to 15th	16th to 20th	20th to 30th	ADB For the month	Monthly Interest Payment
January					
Balance	$ 1,000.00	$ 2,000.00	$ 2,000.00		
Calculations	15000	10000	20000	$ 1,500.00	$ 43.75
February					
Balance	$ 2,043.75	$ 3,043.75	$ 2,043.75		
Calculations	30656.25	15218.75	20437.50	$ 2,210.42	$ 64.47
March					
Balance	$ 2,108.22	$ 3,108.22	$ 2,108.22		
Calculations	31623.31	15541.10	21082.20	$ 2,274.89	$ 66.35
April					
Balance	$ 2,174.57	$ 3,174.57	$ 2,174.57		
Calculations	32618.57	15872.86	21745.71	$ 2,341.24	$ 68.29
May					
Balance	$ 2,242.86	$ 3,242.86	$ 2,242.86		
Calculations	33642.86	16214.29	22428.57	$ 2,409.52	$ 70.28
June					
Balance	$ 2,313.14	$ 3,313.14	$ 2,313.14		
Calculations	34697.03	16565.68	23131.35	$ 2,479.80	$ 72.33
July					
Balance	$ 2,385.46	$ 3,385.46	$ 2,385.46		
Calculations	35781.94	16927.31	23854.63	$ 2,552.13	$ 74.44

August						
Balance	$ 2,459.90	$ 3,459.90	$ 2,459.90			
Calculations	36898.50	17299.50	24599.00	$ 2,626.57	$	76.61

September						
Balance	$ 2,536.51	$ 3,536.51	$ 2,536.51			
Calculations	38047.62	17682.54	25365.08	$ 2,703.17	$	78.84

October						
Balance	$ 2,615.35	$ 3,615.35	$ 2,615.35			
Calculations	39230.26	18076.75	26153.51	$ 2,782.02	$	81.14

November						
Balance	$ 2,696.49	$ 3,696.49	$ 2,696.49			
Calculations	40447.39	18482.46	26964.93	$ 2,863.16	$	83.51

December						
Balance	$ 2,780.00	$ 3,780.00	$ 2,780.00			
Calculations	41700.03	18900.01	27800.02	$ 2,946.67	$	85.94

Total Interest for 2025	*$*	*865.95*
Ending balance for 2025	*$*	*2,780.00*

4. Synchrony Bank Balance Calculation

4.1 Calculations

Annual Interest Rate	35%
Daily Interest Rate	0.000972222
$1000 charged on the 15th of the month	
$1000 paid on the 20th of the month	
Interest compounded daily	

January		
Balance	$	2,044.26
Interest	$	44.26
February		
Balance	$	2,109.66
Interest	$	65.39
March		
Balance	$	2,176.98
Interest	$	67.33
April		
Balance	$	2,246.30
Interest	$	69.32
May		
Balance	$	2,317.66
Interest	$	71.37
June		
Balance	$	2,391.14
Interest	$	73.48
July		
Balance	$	2,466.79
Interest	$	75.65

Day	Dec	Balance
		$ 2,792.45
1	$ 2.71	$ 2,795.17
2	$ 2.72	$ 2,797.89
3	$ 2.72	$ 2,800.61
4	$ 2.72	$ 2,803.33
5	$ 2.73	$ 2,806.05
6	$ 2.73	$ 2,808.78
7	$ 2.73	$ 2,811.51
8	$ 2.73	$ 2,814.25
9	$ 2.74	$ 2,816.98
10	$ 2.74	$ 2,819.72
11	$ 2.74	$ 2,822.46
12	$ 2.74	$ 2,825.21
13	$ 2.75	$ 2,827.95
14	$ 2.75	$ 2,830.70
15	$ 2.75	$ 3,833.45
16	$ 3.73	$ 3,837.18
17	$ 3.73	$ 3,840.91
18	$ 3.73	$ 3,844.65
19	$ 3.74	$ 3,848.38
20	$ 3.74	$ 2,852.13
21	$ 2.77	$ 2,854.90
22	$ 2.78	$ 2,857.67
23	$ 2.78	$ 2,860.45
24	$ 2.78	$ 2,863.23
25	$ 2.78	$ 2,866.02
26	$ 2.79	$ 2,868.80
27	$ 2.79	$ 2,871.59
28	$ 2.79	$ 2,874.38
29	$ 2.79	$ 2,877.18
30	$ 2.80	$ 2,879.98
Interest Sum:	$ 87.52	

August		
Balance	$	2,544.68
Interest	$	77.89

September		
Balance	$	2,624.88
Interest	$	80.19

October		
Balance	$	2,707.44
Interest	$	82.57

November		
Balance	$	2,792.45
Interest	$	85.01

December		
Balance	$	2,879.98
Interest	$	87.52

Total Interest for 2025	*$*	*879.97*
Ending balance for 2025	*$*	*2,879.98*

4.2 Fundamental Differences

- Comparing the first three months of the Synchrony Bank calculations versus the Average Daily Balance method shown previously, we can see that the interest accrues much quicker when compounded daily, versus at the end of the billing cycle. Using the Average Daily Balance method, Carl would have paid $174.57 in interest over the first quarter, while having paid $176.98 in intertest as calculated by Synchrony Bank. This may not seem like a lot, at face value; however, over the course of one year, you would pay approximately 2% more interest.

5. Test Cases

- If implemented correctly, the only difference in result of a test case would be based on when the interest is compounded. For the Average Daily Balance method, I would still calculate the interest each day, but I would sum it up and compound it at the end of the month, as opposed to daily for the Synchrony Bank method. This will make implementation much easier, as well as testing.
- Regarding the specifics of the test, the parameters needed would be the length of the period (I assume it will be one month), previous balance, the transactions during the period and which method for interest calculation is being used. The interest rate would be fixed in the program or possibly set via the graphical user interface.

- For a test of 1 month, with a previous balance of $2000, charges of $1000 on the 15th, payment of $1000 on the 20th, the result should be $34.03 for the Average Daily Balance method and $34.50 for the Synchrony Bank method.
- Due to the usage of floating-point numbers, it is advisable to avoid relying on exact values for test results and instead establish appropriate upper and lower bounds.