Chapter 9 - Consumer Loans (Amortization)

Consumer loans differ from credit cards in that payments are agreed upon and scheduled for a specific period of time to reach a zero balance. Credit cards can carry balances indefinitely, more so when large balances are maintained and when only minimum payments are made. This also transpires when balances remain stagnant or rise due to additions in principal.

Consumer loans provide the ability for stabilization and predictability as the payments are usually fixed coupled with planned payment schedule. **Consumer Loans** typically apply to large tick items such as automobiles, boats, motorcycles, student loans and mortgages.

When speaking in tongue about paying off a loan it is based on **amortization** which by definition (is the distribution of payment into multiple cash flow installments, as determined by an amortization schedule). If the APR is fixed, each payment consists of principal and interest and the monthly payments are calculated in **equal installments** (same payment each month throughout the loan term). At the beginning of the loan, a large portion of each payment is devoted to interest (which is more prevalent with large principal balances), however as the loan matures, larger portions go towards paying down the principal.

If the APR is variable the number of payments and principal remain the same, however the interest will increase of decrease affecting the total payment in a given monthly cycle. The formula to calculate amortization is as follows:

$$P = A \cdot \frac{1 - \left(\frac{1}{1+r}\right)^n}{r}$$

A = payment Amount per period
P = initial Principal (loan amount)
r = interest rate per period
n = total number of payments or periods

Amortization in simple form says that each payment goes toward paying interest and reducing principal, which is the outstanding loan amount. Each month, the payment first covers the interest and the remainder goes toward the principal. The interest amount is calculated by multiplying the interest rate by the loan balance.

Producing values in the formula is a time consuming undertaking, however there are a plethora of amortization calculators on the Internet that will perform the job. For example, say Jasper has a student loan for $12,000 and with 9% interest and a loan term of 72 months. The basic amortization calculator will have these inputs:

Loan Amount: 12,000
Loan Term (years): 6
Interest Rate: 9%
Start Date: July 2012

From there the calculator will produce a monthly or year schedule for the entire loan term with a monthly payment of $216.31. (Some months are $216.30 depending on rounding)

Date	Interest	Principal	Balance
Jul, 2015	$90.00	$126.31	$11,873.69
Aug, 2015	$89.05	$127.25	$11,746.44
Sep, 2015	$88.10	$128.21	$11,618.23

Date	Interest	Principal	Balance
Apr, 2021	$4.79	$211.51	$427.79
Jun, 2021	$3.21	$213.10	$214.70
Jun, 2021	$1.61	$214.70	$0

In the Table above, the interest is all but negated and the principal almost equals the actual monthly payment amount. This schedule is 100% predictable as long as the payments are made on time, however with a variable APR the payment can vary.

Variable Interest Rate
In order to pay off a loan with a ***variable interest rate*** (a fluctuating rate that can change between payment periods), the increase in the interest has to be added to the normal monthly payment to keep the payment cycle on track. This is calculated by taking the interest accumulated in the variable interest rate schedule and subtracting it from the established interest rate at the beginning of the loan.

Date	APR	Interest	Principal	Added Payment	Payment	Balance
Jul, 2015	9%	$90.00	$126.31	NA	$216.31	$11,873.69
Aug, 2015	10%	$98.95	$127.26	$216.31 + 9.90	$226.21	$11,746.44
Sep, 2015	10%	$97.91	$128.21	$216.31 + 9.80	$226.11	$11,618.23

September 2015 variable interest subtracted from September 2015 fixed interest equals $9.90 ($98.95 – 89.05). On the inverse if the interest were to decrease then the calculation would be subtract the variable interest rate from the fixed interest rate schedule. For example, if the interest were to drop to 8% in August the accumulated interest would be $79.16 which is $9.89 lower than the fixed interest at $89.05. This would decrease the payment to from $226.31 to $216.42 ($226.31 - $9.90).

Paying down the Loans
An amortized loan behaves no differently than credit card does in that interest is calculated the same way by taking the monthly rate and multiplying it by the principal balance. The difference is that credit cards derive the principal from an average daily balance due to the ability to increase the principal. The amortized loan always has a known principal balance by way of the schedule.

When it comes to paying down a loan the same rule applies: decrease the principal and it will decrease the amount of interest levied against it. One of the main reasons people borrow through loans rather than a credit card is that there can be tax advantages. Mortgage and student loan

interest can be deducted from taxes and interest from an automobile may apply if it is part of a business. Beyond that a fixed payment schedule creates structure and regularity where as a credit card can get people in trouble because of due to the ability to spend freely. Therefore, if one is going to borrow it should be through a loan and not a credit card. Nevertheless, having a fixed loan doesn't mean one should just borrow when the desire presents itself. Borrowing is baked into the budget, but the same applies in that whenever possible pay down the debt quicker than the prescribed schedule.

The loan that is increasing becoming one of the largest debts in budget is then student loan. The price of tuition typically increases each year and more people in middle age have gone back to school to increase their education and job prospects. These loans tend to rack up more interest as they have terms similar to mortgage payments and in turn last much longer than a car payment.

Making additional payments
Taking $300 student loan payment from Jasper's the established budget, it is based on $18,000 for six years, with an interest rate of 6.198%. Just like paying down the credit cards the same exercise can be performed to reduce interest paid to the lender. Taken from the *Credit Card Management Chapter 8*, money can be taken from one or more of the savings vehicles and applied to the monthly payment which will be set at $250 for the Table below.

Regular Payment				$250 Prepayment		
Month	**Balance**	**Interest**		**Month**	**Balance**	**Interest**
Jan	$17,792.97	$92.97		Jan	$17,542.97	$92.97
Feb	$17,584.88	$91.90		Feb	$17,083.58	$90.61
Mar	$17,375.70	$90.83		Mar	$16,621.82	$88.24
Apr	$17,165.45	$89.75		Apr	$16,157.68	$85.85
May	$16,954.12	$88.66		May	$15,691.14	$83.45
Jun	$16,741.69	$87.57		Jun	$15,222.18	$81.04
Jul	$16,528.16	$86.47		Jul	$14,750.81	$78.62
Aug	$16,313.53	$85.37		Aug	$14,277.00	$76.19
Mar	$16,097.79	$84.26		Mar	$13,800.74	$73.74
Sep	$15,880.94	$83.15		Sep	$13,322.03	$71.28
Oct	$15,662.97	$82.03		Oct	$12,840.84	$68.81
Nov	$15,443.87	$80.90		Nov	$12,357.16	$66.32

In looking at the schedule the interest reduction is not significant in the first year. The total interest after one year with regular payment is $1,043.84 and $957.13 with the $250 additional payment. This equates to only an $86.71 difference however, the interest is reduced by 32.1% in year two 69.6%. If the loan was paid through by regularly scheduled payments an additional $967.70 would accumulate. In total making additional prepayments at $250 saves a total of $1,830.91 in interest and the loan is also paid off in in three years which is three years earlier than the beginning schedule.

Date	Interest Regular Payment	Interest with $250 additional
Year 1	$1,043.84	$957.13
Year 2	$880.83	$597.28
Year 3	$707.43	$214.48
Year 4	$522.96	N/A
Year 5	$326.74	N/A
Year 6	$118.00	N/A
Total	**$3,559.80**	**$1,768.89**

(*Note that additional money added to the loan is considered as a prepayment and should always be applied to the principal*)

9.1 Pay the Credit Card or the Amortized Loan First?

When carrying multiple sources of debt, normally the credit card debt should be paid off first as they are revolving debt and because balances can fluctuate due to increases in principal and amount of time it takes to reach a zero balance by just paying the minimum payment.

Going back to Jasper's student loan, after six years the total interest accumulated is $3,600 without nothing but the regular monthly payment.

Now let's go back to Jasper when he was paying off his credit cards at the same time and it shows that he will pay $3,056.28 in 33 months.

Pay off highest card first	Monthly Payment	Interest Paid
Furniture First @ $331.30 /month	$331.30 until balanced reached zero	$1,101.68
Credit Card Second @ $121.70 /month	Started at $121.70 ended at $453	$2,044.60
33 months to pay		*$3,056.28*

After 33 months of his student loan his interested paid out would be $2,472.11 with 39 months of payment remaining.

Student Loan	Interest Paid to Date
Interest after 33 months	*$2,472.11*

Now that the credit card has been paid off, Jasper can add the $453 to pay off the student loan. At the 33rd month his principal balance would be at $10,572.11 with 39 months of payments remaining. To complete the math go back to the amortization calculator and input the same criteria but add additional payments of $453. You will have to find a amortization calculator that allows for extra payments. (*The calculator below is provided by mtgprofessor.com*).

Enter Loan Information	
New Loan Amount or Existing Loan Balance (e.g. 100000)	10,572.11
Interest Rate (e.g. 7.50)	6.198
☰ New Loan Term or Period Remaining on Existing Loan, in Months (e.g. 360)	39
☰ Number of Monthly Payments in First Year? (1 to 12 - defaultd to 12)	12

DO NOT USE DOLLAR SIGNS ($), COMMAS (,) PLUS SIGNS (+)
OR PERCENTAGE SIGNS (%) IN ANY INPUT BOXES

Enter Extra Payments				
Extra Payment Intervals	Amount of Change	Starting In Month #	Duration	Ending In Month #
Monthly ▼	453	1	Until End of Loan ▼	

Interest Saved & Term Reduction With Extra Payments	Without Extra Payments	With Extra Payments
Loan Term	39 months	15months
Total Interest Paid	$1,127.67	$431.69
Interest Saved Over Monthly Payment Loan		$695.98
Loan Term Will be Shortened By:		24 months

So we can see that the total interest is $431.69 and with the extra payments $695.98 is reduced in interest with a total of 24 months saved. Putting the totals together we see the benefits of paying down the credit card first and then applying it to the student loan.

Item	Interest Paid
Furniture & Credit Card	$3,056.28
Student Loan first wave 33 months	$2,472.11
Student Loan second wave 15 months	$431.69
Total Interest Paid	$5,960.08

Paying the Amortized Student Loan First
In going back to the budgeted payments for the credit cards we see that the amounts will change:

Financing	APR	Balance	Interest	Min Pmt	Budget Pmt	New Pmt
Furniture	24%	$5,000.00	$100.00	$153	$153	$153
Credit Card	17%	$6,000.00	$85.00	$121.70	~~$300~~	$121.70

The new payment will now be $274.70 rather than the old total between the credit cards which was $453. This means an additional $178.30 will go toward the student loan. (In the calculation

the monthly payment will be the same for the credit cards noting that the minimum payment for these cards would reduce each month)

With the $178.30 added as an additional payment the loan will be paid off 42 months totaling $2,066.97 interest.

Basic Loan Information	
Loan Amount	$18,000.00
Interest Rate	6.198%
Loan Term (in months)	72
Monthly Payment	$300.00
# of Pmts - 1st Year:	12

Extra Payments				
Interval	Amount	Start in Month	Duration	End in Month
Monthly	$178.30	1	Until End of Loan	

Interest Saved & Term Reduction With Extra Payments	Without Extra Payments	With Extra Payments
Loan Term	72 months	42months
Total Interest Paid	$3,599.78	$2,066.97
Interest Saved Over Monthly Payment Loan		$1,532.81
Loan Term Will be Shortened By:		30 months

The next step is to see where the credit cards stand at that time. With the student loan paid off there is $478.30 ($300 + $178.30) in additional money to use toward the cards.

Item	Balance	Current Monthly Interest	Interest Paid to Date
Furniture after 42 months	$1,951.69	$38.27	$2,918.69
Credit Card after 42 months	$4,164.80	$58.18	$2,911.10
Total Interest Paid			$5,829.79

The next move is to pay down on the credit card as it accumulating the most interest. So with the current payment of $121.70, adding $478.30 generates a new monthly payment of $600. With that new amount the card will be paid off in the 50th month and with an interest grand total paid of $3,147.83.

At this point the furniture card has principal balance of $985.75 and will receive a one-month payment of $679.33 due to the partial payment from the credit card and will be paid off in the 51st month due to having only having $321.73 remaining. The total interest accumulated comes to $3,147.06.

Credit Card vs Student Loan Interest Comparison

Pay off student loan first	Total Interest
Student loan first	$2,066.97
Furniture and credit card second	$6,294.89
51 months to pay	*$8,361.86*
Pay off credit cards first	Total Interest
Furniture and credit card first	$3,056.28
Student loan first second	$2,903.80
48 months to pay	*$5,960.08*

The answer is clear as in the credit card management that paying off the student loan and credit cards reveals that whatever is charging the most interest at a current state and over time is the correct order of operation.