Asset-Based Lending smart contract

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Contract premise

Alice possesses certain quantity of asset *Principal_Asset* that she does not currently utilize, but wants to extract some value from.

Bob possesses asset *Collateral_Asset*, but needs some P amount of asset *Principal_Asset* temporarily.

Bob does not want to sell *Collateral_Asset*, because he predicts that its value or utility will be higher in the future than what the current market value, for tax reasons, etc.

Bob is willing to pay the for the temporary use of P while offering C amount of *Collateral_Asset* as a guarantee of repayment to the creditor.

Contract can be terminated at any time by any settlement that is mutually agreed by the two parties.

Basic Asset-Based Loan contract

t_0 is the point in time when contract begins

t_1 is the point in time when the pre-agreed duration has passed since t_0

Interest rate R is pre-agreed

Alice is willing to give out P to Bob, provided that:

- Before t_1, she will receive $P + P * R$
- Otherwise, at or after t_1, she will be able to claim C

Bob is willing to freeze C for certain period, provided that:

- He will receive P immediately
- If $P + I$ is repaid before t_1, he can recieive C back

Bob agrees that if $P + I$ is not repaid before t_1, Alice can claim C for herself.

To enter the contract, Alice and Bob create and cooperatively sign a transaction that:

- Sends P, provided by Alice, to Bob's address
- Sends C, provided by Bob, to the address of a script that enforces the terms of the contract above

This contract is simple, but limited. It requires for principal to be repaid in one lump sum, it is often preferable for the principal to be repaid in portions over time.

Asset-Based Loan contract with partial repayments

The repayment is split into N installments.

M consecutive missed payments lead to collateral forfeiture.

The number of possible steps in the contract is in the $[S_{min}, S_{max}]$ range [1],
$S_{min} \in [\min\{N, M\}, N + M]; S_{max} \in [\max\{N, M\}, N + M]$

The contract can progress over total $S_{max} + 1$ time periods, and $t_0 \dots t_{S_{max}}$ are the points in time at the beginning of each period.

The rates used for calculation of interest or surcharge are pre-agreed:

- R_D is the rate for regular repayments *due*
- R_E is the rate for surcharge on *early* repayments
- $R_{L(1)} \dots R_{L(M-1)}$ are the rates for surcharge on *late* repayment: $R_{L(1)}$ is applied when one payment is missed, $R_{L(2)}$ is applied when two consecutive payments are missed, and so on

n is the number of partial repayments, $n \in [0, N]$

m is the number of missed payments, $m \in [0, M]$

B is the outstanding principal balance

$F_P = \frac{P}{N}$ is installment size (the "Fraction of P")

$D = \min\{F_P * (m + 1), B\}$ is the portion of the balance currently *due* to be repaid [2]

$L = \min\{F_P * m, B\}$ is the amount the repayment is *late* on

At t_0:

- $n = 0$
- $m = 0$
- $B = P$

Alice is willing to give out P to Bob, provided that:

- Before each $t_s, s \in [1, S_{max}]$ she will receive $D + D * R_D + L * R_{L(m)}$, and then:
  - n will be incremented
  - m will be reset to 0
  - B will be decreased by D
- Otherwise, m will be incremented
- If $m \geq M$, or after $t_s, s \geq S_{max}$, she will be able to claim C

Alice agrees that before t_{N-1}, B can be set to 0 if Bob repays
$B + D * R_D + (B - D) * R_E + L * R_{L(m)}$

Bob is willing to freeze C for certain period, provided that:

- He will receive P immediately
- When the condition $B = 0$ is reached during contract execution, he can receive C back

Bob agrees that Alice can claim C for herself if the condition $m \geq M$ or $s \geq S_{max}$ is reached during contract execution

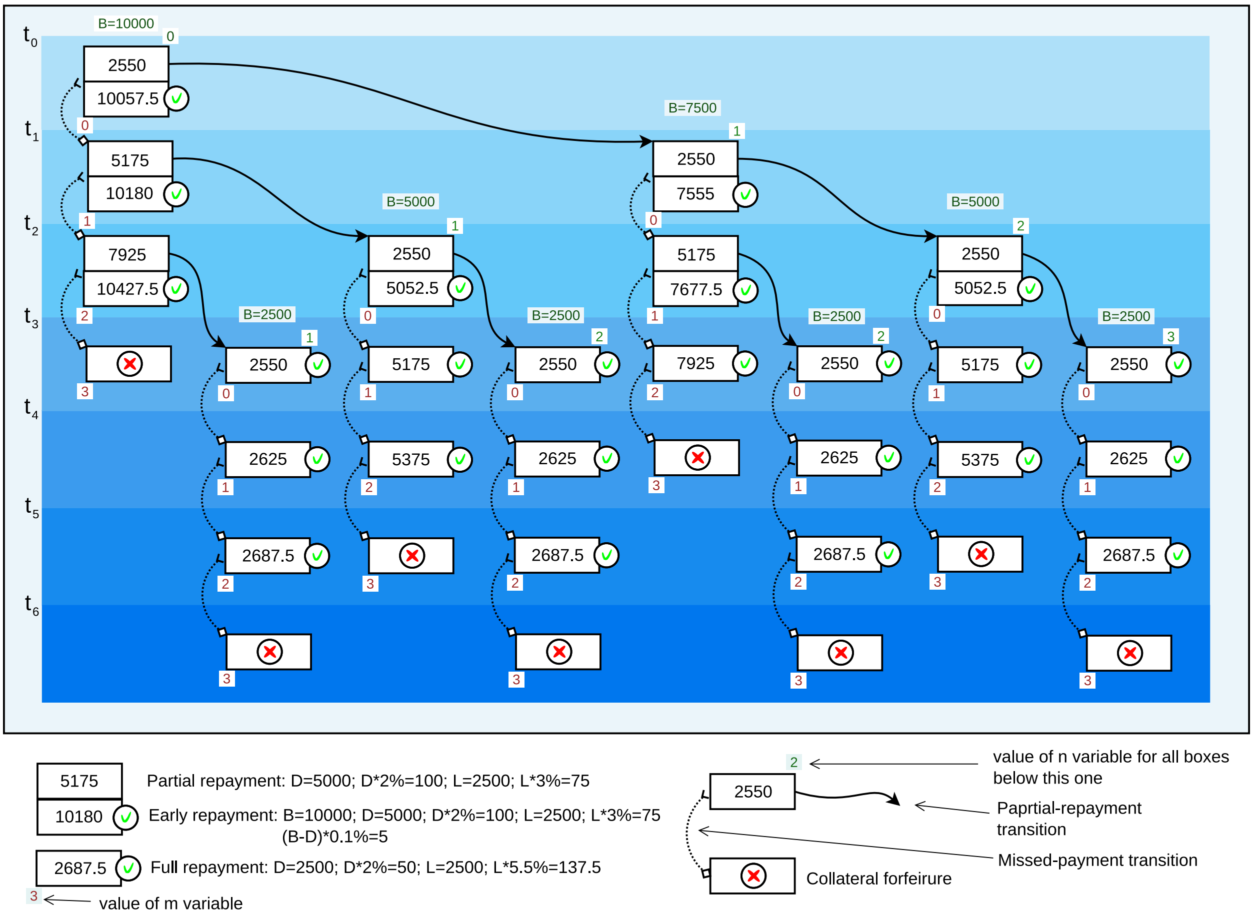
To enter the contract, Alice and Bob create and cooperatively sign a transaction that:

- Sends P, provided by Alice, to Bob's address
- Sends C, provided by Bob, to the address of a script that enforces the terms of the contract above

Examples

The following scheme illustrates the contract with:

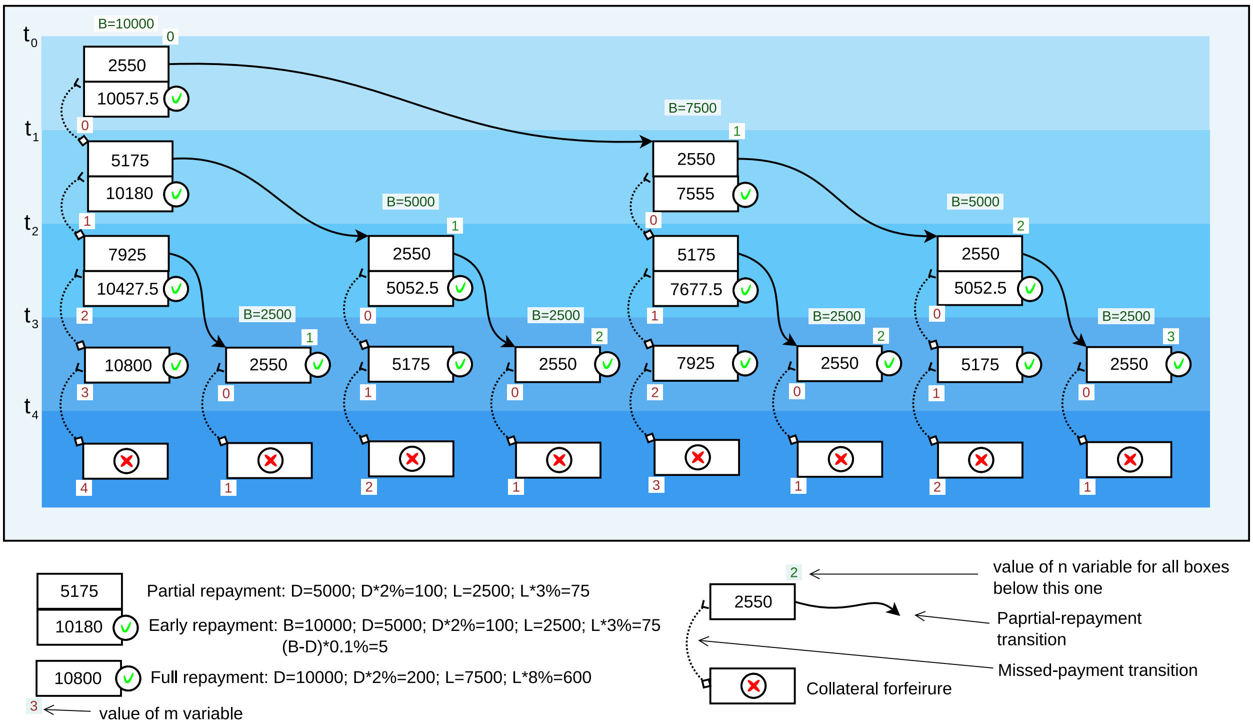
- $P = 10000$
- $N = 4, M = 3$
- $S_{min} = 4, S_{max} = 6$
- $R_D = 0.02, R_E = 0.001, R_L = (0.03, 0.055)$ which corresponds to 2%, 0.1%, (3%, 5.5%)



The following scheme illustrates the contract with:

- $P = 10000$
- $N = 4, M = 4$
- $S_{min} = 4, S_{max} = 4$
- $R_D = 0.02, R_E = 0.001, R_L = (0.03, 0.055, 0.08)$ which corresponds to (2%, 0.1%, (3%, 5.5%, 8%)).

The layout with $N = M = S_{min} = S_{max}$ allows to have the collateral forfeiture event to always happen in one particular period.



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[1] When $S_{min} = S_{max}$, the contract will always finish in these fixed number of steps (not taking early repayment events into account). This might be desireable because this means that the window of time when Alice will be able to claim the collateral is narrowed, simplifying risk assessment. But this also means that while M missed payments lead to collateral forfeiture from t_0, at t_1 this becomes $M - 1$, and at t_{N-1} no missing payments will be allowed.

[2] With presented simple formula, D for the last repayment equals $P \bmod N$.

In most cases P will likely be much larger than N, and last repayment will be very small in this case. Simpler formula is easier for understanding, but for real application, it makes sense to just make the last repayment slightly bigger than others, and the more complex formula should be used:

$$D = \begin{cases} F_P * (m+1) & \text{if } (F_P * (m+1) + P \bmod N) \geq B \\ B & \text{otherwise} \end{cases}$$