



Semantics of Business Vocabulary and Business Rules (SBVR), v1.5

Annex H - The RuleSpeak[®] Business Rule Notation

OMG Document Number: formal/19-10-07

Note: This SBVR Annex is published as a separate document solely for convenience and ease of use. The fact that it is published as a separate SBVR specification document makes no change to its status as part of the SBVR specification, or the way in which it can be updated under OMG Policies and Procedures.

Annex H - The RuleSpeak[®] Business Rule Notation

(informative)

H.1 General

RuleSpeak[®] is an existing, well-documented¹ business rule notation developed by Business Rule Solutions, LLC (BRS) that has been used with business people in actual practice in large-scale projects since the second half of the 1990s.

Annex A presented a business rule notation within SBVR Structured English that features prefixing rule keywords onto appropriate propositions. RuleSpeak can also use the constructs of SBVR Structured English, but embeds equivalent keywords within the propositions themselves (mixfix).

As discussed in Annex E, more than one notation for expressing business rules is possible using SBVR Structured English. (This is probably also true for other notations compliant with SBVR). Regardless of how expressed, equivalent semantics can be captured² and formally represented as logical formulations.

The following selected examples using the EU-Rent case study illustrate use of RuleSpeak. The complete set of examples for EU-Rent in RuleSpeak is provided in sub clause H.3, with additional comments.

- | | | |
|---|--|--|
| 1 | Structural business rule
RuleSpeak version | It is necessary that each <u>rental</u> has exactly one <u>requested car group</u> .
Each <u>rental</u> always has exactly one <u>requested car group</u> . |
| 2 | Operative business rule
RuleSpeak version | It is obligatory that the <u>rental duration of each rental</u> is at most <u>90 rental days</u> .
The <u>rental duration of a rental</u> must not be more than <u>90 rental days</u> . |
| 3 | Operative business rule
RuleSpeak version | It is obligatory that each <u>driver of a rental</u> is <u>qualified</u> .
A <u>driver of a rental</u> must be <u>qualified</u> . |
| 4 | Operative business rule
RuleSpeak version | It is obligatory that the <u>rental</u> incurs a <u>location penalty charge</u> if the <u>drop-off location of a rental</u> is not the <u>EU-Rent site that is base for the return branch of the rental</u> .
A <u>rental</u> must incur a <u>location penalty charge</u> if the <u>drop-off location of the rental</u> is not the <u>EU-Rent site that is base for the return branch of the rental</u> . |

1. [Ross2003], Clauses 8-12. Versions of RuleSpeak have been available on the Business Rule Solutions, LLC website (www.BRSolutions.com) since the late 1990s. Public seminars have taught the syntax to thousands of professionals starting in 1996 (www.AttainingEdge.com). The original research commenced in 1985, and was originally published in 1994 [Ross1997].

2. For a business-oriented, SBVR-compliant approach, see [Ross2005], Clauses 4-5.

- 5 Operative business rule It is necessary that the rental charge of a rental must be calculated in the business currency of the rental.
- RuleSpeak version** The rental charge of a rental is always calculated in the business currency of the rental.
- 6 Operative business rule It is permitted that a rental is open only if an estimated rental charge is provisionally charged to a credit card of the renter that is responsible for the rental.
- RuleSpeak version** A rental may be open only if an estimated rental charge is provisionally charged to a credit card of the renter that is responsible for the rental.
- 7 Operative business rule It is obligatory that at the actual return date/time of each in-country rental and each international inward rental the local area that includes the return branch of the rental owns the rented car of the rental.
- RuleSpeak version** The local area that includes the return branch of an in-country rental or international inward rental must own the rented car of the rental at the actual return date/time of the rental.
- 8 Operative business rule It is obligatory that at the actual pick-up date/time of each rental the fuel level of the rented car of the rental is full.
- RuleSpeak version** The fuel level of the rented car of a rental must be full at the actual pick-up date/time of the rental.
- 9 advice of possibility It is possible that the notification date/time of a bad experience that occurs during a rental is after the actual return date/time of the rental.
- RuleSpeak version** The notification date/time of a bad experience that occurs during a rental is sometimes after the actual return date/time of the rental.
- 10 advice of permission It is permitted that the drop-off branch of a rental is not the return branch of the rental.
- RuleSpeak version** The drop-off branch of a rental need not be the return branch of the rental.

H.2 Expressions in RuleSpeak

RuleSpeak builds on the same expression forms described in Annex A (A.1), with the minor difference that distinct keywords are used for the Modal Operations related to business rules. The following sub clause presents the RuleSpeak alternative rule keywords for Rules and Advices.³

H.2.1 Modal Operations in RuleSpeak

Modal claim type	Statement form	SBVR Structured English keywords	RuleSpeak keywords
obligation formulation	‘obligative statement’ form	it is obligatory that p	r must s
obligation formulation embedding a logical negation	‘prohibitive statement’ form	it is prohibited that p	r must not s
	‘restricted permission statement’ form	it is permitted that p only if q	r may s only t
permissibility formulation	‘unrestricted permission statement’ form	it is permitted that p	r may s r need not s
necessity formulation	‘necessity statement’ form	it is necessary that p	r always s
necessity formulation embedding a logical negation	‘impossibility statement’ form	it is impossible that p	r never s
	‘restricted possibility statement’ form	it is possible that p only if q	r can s only t
possibility formulation	‘unrestricted possibility statement’ form	it is possible that p	r sometimes s r can s

NOTES:

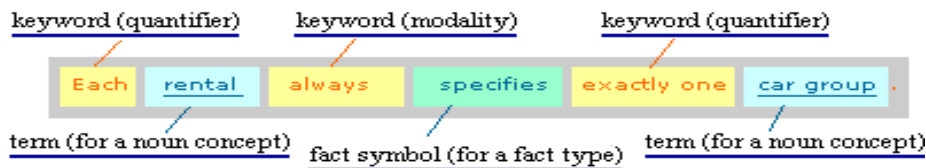
- p and q , and r , s , and t , are all parts of the same proposition, say u .
- In a permissibility formulation or a possibility formulation, the ‘only’ is always followed immediately by one of the following:
 - an ‘if’ (yielding ‘only if’).
 - a preposition.
 An example of a business rule statement using the ‘only [preposition]’ form is the following:
 A spot discount for a rental may be given **only** by a branch manager.

3. It is important to note that use of these keywords must be in a context that is clearly indicated to be for Rules and Advices only.

H.2.2 Example in RuleSpeak

Each rental always specifies exactly one car group.

The example above includes three keywords or phrases, two terms, and one verb symbol, as illustrated below.



As noted above, every Operative Business Rule or Advice can be stated by using one of the following embedded keywords.

must	or should	rule keyword
must not	or should not	rule keyword
may ... only	often as in may ... only if	rule keyword
may	or need not	advice keyword

Every Structural Rule or Advice can be stated by using one of the following embedded keywords.

always		rule keyword
never		rule keyword
can ... only	often as in can ... only if	rule keyword
sometimes	or not always	advice keyword

Special-purpose keywords for indicating specific kinds of Structural Rules include the following. In these forms, “always” is assumed implicit.

is to be considered		for derivation or inference
is to be computed as		for computation
is to be fixed at [number]	or is to be [number]	for establishing constants

Among the most basic usage rules and guidelines of RuleSpeak are the following. (Note that these usage rules and advices are given using proper RuleSpeak notation.)

1. ‘Should’ may be used in place of ‘must’ in expressing a business rule only if one of the following is true:
 - The business rule does not have an enforcement level.
 - The business rule has an enforcement level, and that enforcement level is consistent with the English sense of ‘should’.

Comment: To say this differently:

‘Should’ must not be used in place of ‘must’ in expressing a business rule if all of the following are true:

- The business rule has an enforcement level.
- The enforcement level of the business rule is inconsistent with the English sense of ‘should’.

2. ‘May’ **must** be used in the sense of “permitted to” in RuleSpeak. ‘May’ **must not** be used in the sense of “might.”⁴
3. An advice **must not** include a rule keyword.
4. A statement expressing a rule or advice **should not** begin with a condition.

Comment: ‘Condition’ as used here means a qualification set off by ‘if’, ‘while’, ‘when’, etc. (e.g., if a rental is open...).

5. A double negative **should** be avoided in expressing a rule in RuleSpeak.

Comment: Double negatives, especially using two ‘not’s, are generally undesirable in good English usage, and often prove particularly troublesome in rule statements.

Example.

Rule: A withdrawal from an account **must not be made** if the account is not active.

Revised rule: A withdrawal from an account **may be made only if** the account is active.

Comment: The revised rule is expressed in the form of a ‘restricted permissive statement.’

H.3 Concepts, Definitions, and Rules: RuleSpeak Practices

SBVR is very flexible in supporting alternative practices with respect to rules and definitions. This flexibility is enabled by the underlying logical formulations and their underpinning in formal logic.

Two core RuleSpeak practices with respect to definitions are the following:⁵

1. **“Essence” by Definitions.** A definition should always focus on the core essence of a concept – that is, on *fundamental* meaning that is unlikely to change. Such meaning is expressed as naturally as possible. The form of language used in common dictionaries is strongly preferred.
2. **“Boundaries” by Rules.** *All* constraints should be expressed as rules separate from definitions. Such rules generally define the ‘boundary conditions’ of a concept; that is, when something is or is not an instance of the concept. Since specific boundaries for a concept (e.g., “gold customer”) can change over time, they should not be embedded in definitions. An additional advantage – crucial for communication with and among business people – is that the underlying vocabulary can be kept as compact and as focused as possible.

Experience in large-scale projects indicates these core practices:

- Ensure good business communication.
- Produce friendly and highly stable definitions.
- Scale extremely well for complex business problems featuring hundreds or thousands of rules.

RuleSpeak might therefore be characterized as more ‘rule-ish’ than the approach described in Annex G. RuleSpeak is well-suited for practitioners who want to:

4. [Ross2003], p. 130.

5. [Ross2005], Clause 4, pp 51-52.

- Move faster to rule capture.
- Use more natural (less formal) wordings for definitions.

These issues are pragmatic concerns for business rule projects. It is important to remember, of course, that under SBVR either approach (and others) can produce identical semantics ‘under the covers’ (i.e., in logical formulations).

H.3.1 Example in RuleSpeak

A EU-Rent definition and set of related specifications taken from Annex G concerning “agency” (a type of “branch”) serve to illustrate. The RuleSpeak approach is outlined subsequently.

H.3.1.1 Sample Definition and Related Specifications for “Agency” from Annex G

‘Agency’: service desks in hotels, travel agents, etc. They have storage space for few cars, and are operated on demand by part-time staff who will typically do the entire workflows for rental and return.

agency

Concept Type: branch type
 Definition: branch that does not have an EU-Rent location and has minimal car storage and has on-demand operation

rental organization unit **having a EU-Rent location**

Concept Type: characteristic
 Definition: rental organization unit that is based at an EU-Rent site that is owned by EU-Rent
 Note: Some things are based at EU-Rent sites that are owned by third parties such as hotels and travel agents.

rental organization unit **having minimal car storage**

Concept Type: characteristic
 Definition: rental organization unit that has car storage that can accommodate a small number of rental cars

rental organization unit **having on-demand operation**

Concept Type: characteristic
 Definition: rental organization unit that has hours of operation that are flexible in response to customer demand

H.3.1.2 RuleSpeak Approach for the “Agency” Example

1. Find a suitable definition from a standard dictionary, or if available, an industry glossary, to serve as the basis for the definition. The Merriam-Webster Unabridged Dictionary offers the following for “agency,” an appropriate basis for an ‘essence’ definition.

*4a: an establishment engaged in doing business for another *an advertising agency* *an employment agency**

agency

Concept Type: [branch type](#)

Definition: another company engaged in conducting EU-Rent business operations

2. Define Verb Concepts for ‘agency’. For this example, assume an agency has the following (binary) verb concepts by virtue of being a branch. These verb concepts would probably be indicated as properties.

- [branch has location](#)
- [branch has car storage capacity](#)
- [branch has operating mode](#)

Comments:

- RuleSpeak does not emphasize using characteristics for building definitions.
 - In practice, verb concepts are generally not given definitions in RuleSpeak. When the meaning of a verb concept is the dictionary meaning for the verb phrase in the context of well-defined noun concepts for the things that play the roles, a definition for the verb concept itself generally adds very little.
 - For the sake of simplicity, assume that location, car storage, and operating mode already have suitable definitions.
3. Define the appropriate structural rule(s) to establish (current) ‘boundaries’ for the concept ‘agency’. Note that these ‘boundaries’ might be modified, expanded, or contracted over time.

All of the following are always true for an [agency](#):

- It *has* a [third-party location](#).
- It *has* a [minimal car storage capacity](#).
- Its [operation mode](#) *is on-demand*.

4. Specify structural rules for derived terms (e.g., “third-party location,” “minimal,” etc.).

A [location](#) *is to be considered* a [third-party location](#) *if located at* a [EU-Rent site](#) *that is owned by* a [third party](#).

The [car storage capacity of a branch](#) *is to be considered* [minimal](#) *if less than ... [condition(s)]*

5. Ensure all non-derived terms have “essence” definitions.

on-demand

Definition: flexible in response to customer demand

Comment: Derived concepts are generally not given definitions in RuleSpeak since the structural rule(s) for them are, literally, *definitive*.

H.3.2 Structural Rules vs. Operative Rules

In RuleSpeak, the distinction between structural rules and operative rules is viewed as follows.⁶

- *Structural rules* prescribe criteria for how the business chooses to organize (“structure”) its business semantics. Such rules express criteria for correct decisions, derivations, or business computations. Structural rules supplement definitions.

6. [Ross2005], Clauses 5 and 6.

- *Operative business rules* focus directly on the propriety of conduct in circumstances (business activity) where willful or uninformed actions can fall outside the boundaries of behavior deemed acceptable. Unlike structural rules, operative rules can be violated *directly*.

The distinction is clear-cut in most cases; in some, it is more difficult. For example, consider “booking” in the EU-Rent case study. “Booking” (like “order,” “reservation,” “registration,” etc.) is essentially a ‘made-up’ device of the business. It is an artifact of knowledge that exists ‘simply’ to help manage complex, expensive resources.

Therefore, rules about creating bookings (e.g., that the requested pick-up date-time is to be **after** the booking date-time) are to be viewed as structural. If not followed (applied) in attempting to make a booking, no booking results. In other words, since bookings are a knowledge ‘thing,’ the business can establish definitive rules for them. These are the “boundary” rules discussed earlier.

Now consider “actual pick-up date-time,” the date-time when possession of a rental car is actually handed over to a rental customer (or is *said* to have been anyway). EU-Rent might want to avoid post-dating handovers (i.e., have a rule that the actual pick-up date-time is to be after the booking date-time).

This case is quite different. “Actual pick-up date-time” reflects activity (or the communication thereof) outside the realm of knowledge artifacts (i.e., conduct that takes place in the ‘real world’). Because such rules can be broken (by people), they are operative.

Refer to the Rule Speak best practices presented in [Ross2005].⁷

H.4 Complete Set of EU-Rent Examples in RuleSpeak

This sub clause provides one-by-one RuleSpeak counterparts for the EU-Rent guidance (business rules and advices) presented in Annex G⁸. This restatement provides semantically equivalent expression that is more business friendly.

Comment: Many of the guidance statements in Annex G are supported by descriptions, which reflect EU-Rent users’ informal statements of the guidance, and by verb concepts and levels of enforcement. That material has been removed from here for the sake of brevity. Refer to Annex E for details.

H.4.1 Rule Set -- Rental Rules

It is necessary that each rental *has* exactly one requested car group.

A rental always *has* exactly one requested car group.

Comment: “A” may be used in place of “each” with no change in meaning, as follows⁹.
(This note will not be repeated subsequently.)

Each rental always *specifies* exactly one car group

Guidance Type: structural business rule

7. [Ross2005], Clause 6, pp. 107-108.

8. As of the time of this writing.

9. [Ross2003]

It is necessary that each rental *has* exactly one rental period.

A rental always *has* exactly one rental period.

Guidance Type: structural business rule

It is necessary that each rental *has* exactly one return branch.

A rental always *has* exactly one return branch.

Guidance Type: structural business rule

It is necessary that the scheduled pick-up date/time of each advance rental *is after* the booking date/time of the rental booking that *establishes* the advance rental.

The scheduled pick-up date/time of an advance rental *is always after* the booking date/time of the rental booking that *establishes* the advance rental.

Guidance Type: structural business rule

H.4.2 Rule Set -- Charging / Billing / Payment Rules

It is permitted that a rental *is open* only if an estimated rental charge *is provisionally charged* to a credit card of the renter that *is responsible* for the rental.

A rental may *be open* only if an estimated rental charge *is provisionally charged* to a credit card of the renter that *is responsible* for the rental.

Guidance Type: operative business rule

It is necessary that the rental charge of each rental *is calculated* in the business currency of the rental.

The rental charge of a rental *is always calculated* in the business currency of the rental.

Guidance Type: structural business rule

If the renter of a rental *requests* a price conversion then it is obligatory that the rental charge of the rental *is converted to the* currency of the price conversion.

The rental charge of a rental *must be converted to the* currency of a price conversion *requested by the* renter of the rental.

Comment: RuleSpeak does not recommend the “If ...then...” syntax for operative business rules¹⁰.
(This note will not be repeated subsequently.)

Guidance Type: operative business rule

It is necessary that each cash rental *honors its* lowest rental price.

A cash rental *always honors its* lowest rental price.

Guidance Type: structural business rule

[From Annex E] “The structural business rule above can be elaborated as three detailed structural business rules:”

It is necessary that a cash rental price for a cash rental that is calculated because of EU-Rent price changes *and that is less than the* lowest rental price honored by the rental replaces the lowest rental price honored by the rental.

A cash rental price for a cash rental that is calculated because of EU-Rent price changes *and that is less than the* lowest rental price honored by the rental *always* replaces the lowest rental price honored by the rental.

It is necessary that a cash rental price for a cash rental that is calculated because of changes to the car group or rental duration of a rental replaces the lowest rental price honored by the rental.

A cash rental price for a cash rental that is calculated because of changes to the car group or rental duration of a rental *always* replaces the lowest rental price honored by the rental.

10. [Ross2003].

It is necessary that the lowest rental price honored by a rental is not replaced *after* the actual return date/time of the rental.

The lowest rental price honored by a rental is never replaced *after* the actual return date/time of the rental.

H.4.3 Rule Set -- Driver Rules

It is permitted that a rental is open only if each driver of the rental is not a barred driver.

A rental may be open only if each driver of the rental is not a barred driver.

Synonymous Statement: It is prohibited that a rental is open if a driver of the rental is a barred driver.

A rental must not be open if a driver of the rental is a barred driver.

Guidance Type: operative business rule

It is obligatory that each driver of a rental is qualified.

Each driver of a rental must be qualified.

Guidance Type: operative business rule

H.4.4 Rule Set -- Pick-up / Return Rules

It is obligatory that *at* the actual return date/time of each in-country rental and each international inward rental the local area of the return branch of the rental owns the rented car of the rental.

The local area of the return branch of an in-country or international inward rental must *own* the rented car of the rental at the actual return date/time of the rental.

Guidance Type: operative business rule

It is obligatory that the country of the return branch of each international inward rental is the country of registration of the rented car of the rental.

The country of the return branch of an international inward rental is always the country of registration of the rented car of the rental.

NOTE: RuleSpeak treats this rule as structural, rather than operative, for the reasons given earlier.

Guidance Type: structural business rule

It is necessary that if a rental is open and the rental is not an international inward rental then the rented car of the rental is owned by the local area of the pick-up branch of the rental.

The rented car of a rental is always owned by the local area of the pick-up branch of the rental if the rental is open and the rental is not an international inward rental.

Guidance Type: structural business rule

If the actual return date/time of a rental is after the end date/time of the grace period of the rental then it is obligatory that the rental incurs a late return charge.

A rental must incur a late return charge if the actual return date/time of the rental is after the end date/time of the grace period of the rental.

Guidance Type: structural business rule

If the drop-off location of a rental is not the EU-Rent site that is base for the return branch of the rental then it is obligatory that the rental incurs a location penalty charge.

A rental must incur a location penalty charge if the drop-off location of the rental is not the EU-Rent site that is base for the return branch of the rental.

Guidance Type: operative business rule

If a rental is assigned then it is obligatory that the rental car that is assigned to the rental is stored at the pick-up branch of the rental.

The rental car assigned to a rental must be stored at the pick-up branch of the rental if the rental is assigned.

Guidance Type: operative business rule

At the actual pick-up date/time of each rental it is obligatory that the fuel level of the rented car of the rental is "full".

The fuel level of a rental car assigned to a rental must be "full" at the actual pick-up date/time of the rental.

Guidance Type: operative business rule

H.4.5 Rule Set -- Points Rental Rules

It is necessary that the booking date/time of a points rental is at least 5 days before the scheduled start date/time of the rental.

The booking date/time of a points rental is always at least 5 days before the scheduled start date/time of the rental.

Guidance Type: structural business rule

It is necessary that the renter of each points rental is a club member.

The renter of a points rental is always a club member.

Guidance Type: structural business rule

H.4.6 Rule Set -- Rental Period Rules

It is obligatory that the start date of each reserved rental is in the future.

The start date of a reserved rental must be in the future.

Guidance Type: operative business rule

It is prohibited that the start date of a reserved rental is in the past.

The start date of a reserved rental must not be in the past.

Guidance Type: operative business rule

It is obligatory that the rental duration of a rental is at most 90 rental days.

The rental duration of a rental must be at most 90 rental days.

Guidance Type: operative business rule

If rental₁ is not rental₂ and the renter of rental₁ is the renter of rental₂ then it is obligatory that the rental period of rental₁ does not overlap the rental period of rental₂.

The rental period of rental₁ must not overlap the rental period of rental₂ if all the following are true:

- rental₁ is not rental₂
- the renter of rental₁ is the renter of rental₂.

Guidance Type: operative business rule

H.4.7 Rule Set -- Servicing Rules

It is obligatory that each rental car that is in need of service *has a* scheduled service.

A rental car in need of service must *have a* scheduled service.

Guidance Type: operative business rule

It is obligatory that the service reading of a rental car is at most 5500 miles.

The service reading of a rental car is always at most 5500 miles.

NOTE: RuleSpeak treats this rule as structural, rather than operative, for the reasons given earlier.

Guidance Type: structural business rule

If the rented car of an open rental is *in need of service* or *is in need of repair* then it is obligatory that the rental *incurs a* car exchange during rental.

An open rental must *incur a* car exchange during rental if the rented car of the rental is *in need of service* or *is in need of repair*.

Guidance Type: structural business rule

H.4.8 Rule Set -- Transfer Rules

At the transfer drop-off date/time of a car transfer it is obligatory that the transferred car of the car transfer is owned by the local area that includes the transfer drop-off branch of the car transfer.

The transferred car of a car transfer is always owned at the transfer drop-off date/time of a car transfer by the local area that includes the transfer drop-off branch of the car transfer.

NOTE: RuleSpeak treats this rule as structural, rather than operative, for the reasons given earlier.

Guidance Type: [structural business rule](#)

It is obligatory that the country of the transfer drop-off branch of an international return is the country of registration of the transferred car of the international return.

The country of the transfer drop-off branch of an international return is always the country of registration of the transferred car of the international return.

NOTE: RuleSpeak treats this rule as structural, rather than operative, for the reasons given earlier.

Guidance Type: [structural business rule](#)

Synonymous Statement: It is prohibited that the country of the transfer drop-off branch of an international return is not the country of registration of the transferred car of the international return.

NOTE: A RuleSpeak expression of the Synonymous Statement has been intentionally omitted. The form “prohibited ... not” (or impossible ... not”) is actually a double negative, which as noted earlier, RuleSpeak always discourages because it inevitably causes confusion.

- Prohibited that ... not” is equivalent to “obligatory that not ... not,” a double negative, which is shown more clearly in RuleSpeak, “must not ... not.”
- Impossible that ... not” is equivalent to “Necessary that not ... not,” which would be more clearly a double negative in RuleSpeak, “never ... not.”

At the drop-off date/time of an international return it is obligatory that the transferred car of the international return is owned by the local area that includes the transfer drop-off branch of the international return.

The transferred car of an international return is always owned at the drop-off date/time of an international return by the local area that includes the transfer drop-off branch of the international return.

NOTE: RuleSpeak treats this rule as structural, rather than operative, for the reasons given earlier.

Guidance Type: [structural business rule](#)

H.4.9 EU-Rent Advices expressed in EU-Rent's English Vocabulary

It is possible that the notification date/time of a bad experience that occurs during a rental is after the actual return date/time of the rental.

The notification date/time of a bad experience that occurs during a rental is sometimes after the actual return date/time of the rental.

Guidance Type: advice of possibility

It is permitted that the rental car that is moved by a car transfer is in need of service.

The rental car moved by a car transfer may be in need of service.

Guidance Type: advice of permission

It is permitted that a renter has more than one advance rental.

A renter may have more than one advance rental.

Guidance Type: advice of permission

It is permitted that the renter of a rental is an additional driver of a rental.

The renter of a rental may be an additional driver of a rental.

Guidance Type: advice of permission

It is permitted that the drop-off branch of a rental is not the return branch of the rental.

The drop-off branch of a rental need not be the return branch of the rental.

Guidance Type: advice of permission