LWBtheory: information about some propositional logics via the WWW

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Abstract. Imagine that you are not sure how the Hilbert-style calculus for S4 looks like, and somebody has taken your book about modal logics off your desk. No problem if you have an internet access: Open `http://lwbwww.unibe.ch:8080/LWBtheory.html` in a WWW browser, search for `Hilbert-style calculus` in the chapter about S4, and after a few seconds you obtain the calculus, together with an example of a proof of a formula in this calculus.
LWBtheory contains only a relatively small amount of information concerning some propositional non-classical logics and non-monotonic systems. However, even if your favourite subjects are not covered, it can be of some interest to you, since it shows the today's possibilities and can help to obtain improved, more comprehensive systems in the future.

1 Introduction

Each year an immense number of papers concerning various aspects of propositional logics are published. However, this information is often not very well accessible. And even if one is aware of a publication, because of the many different notations it can be hard to read it and to compare it with other publications. A beginner may loose a lot of time when he tries to obtain a survey on a subject. The existence of monographs, especially the famous handbooks ([2], [3], [4], ...), improves this situation considerably.
Today, the World Wide Web (WWW) offers new possibilities for such tasks. LWBtheory is a collection of information concerning propositional logics that is available via WWW. It is far from containing as much information as for example the handbooks; on the contrary, the system is still small. On the other hand, LWBtheory has remarkable advantages:

1. high availability
2. search for keywords
3. links between related parts

Even if you consider the offered information as trivial or not interesting, these advantages make it worth to have a look at LWBtheory, in order to see the possibilities WWW provides for such purposes.

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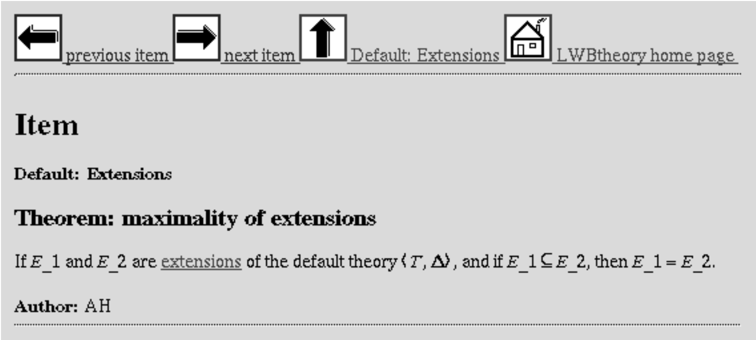
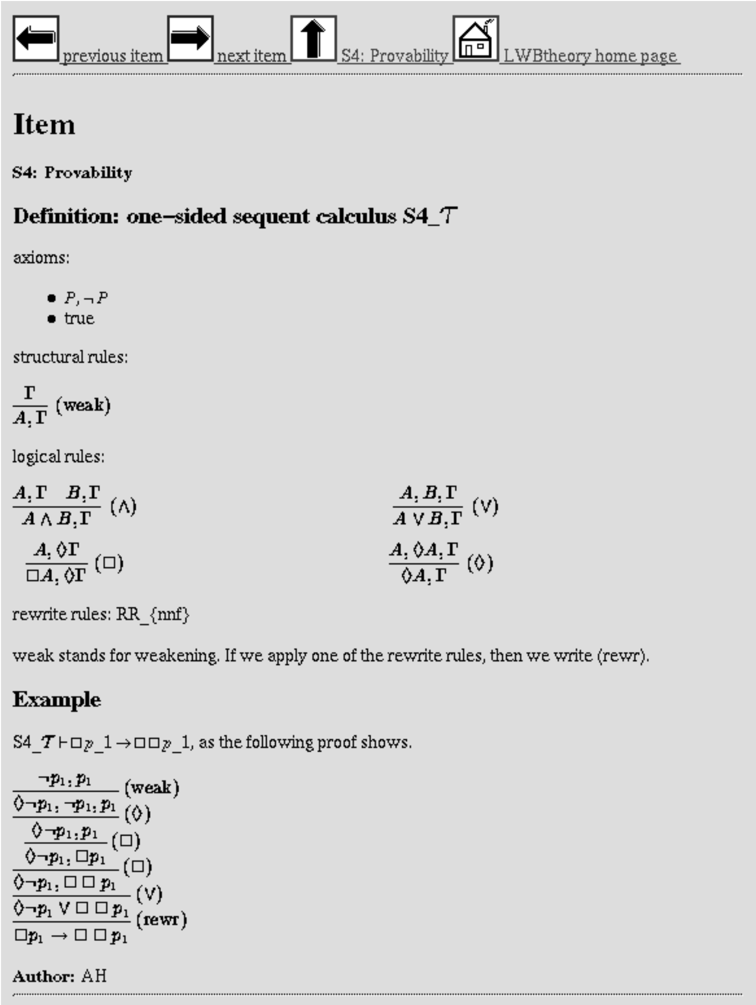


Fig. 1. A short item about propositional default logic. If you click on the underlined word 'extensions' then you obtain the definition of an extension.

2 Using LWBtheory

If you want to use LWBtheory, then start your WWW browser (e.g. Netscape or Mosaic) and open `http://lwbwww.unibe.ch:8080/LWBtheory.html` .
In the following we describe the offered facilities. We assume that you have some experience with WWW applications and do not go in every detail. Of course we can only describe the actual state. Improvements and extensions will change the appearance of LWBtheory in the course of time.
The basic access of the informations takes place via the table of contents. You can choose one of the logics, and inside this logic the section you are interested in. Select then one of the listed item titles. See the figures 1 and 2 for two typical items. Using the 'next' resp. 'previous' buttons you can navigate between succeeding items of a section. In addition, some of the notions defined earlier are represented as links. You can use these links for a fast access to the corresponding definition.
The parts that could not be translated into HTML are displayed as icons. You cannot suppress the loading of the small icons that are used for special symbols (unless your WWW browser offers this possibility). In the near future many of these icons will be replaced by HTML elments. The loading of these symbols sometimes requires some patience, especially if your WWW browser does not load them in parallel. However, if you switch from one item to a related item, then most of these small icons are already in the cache of your WWW browser and are therefore not loaded again. Whether or not the large icons are loaded immediately depends on the configuration (see LWBtheory home page). Turning off the immediate display can considerably shorten the loading times.
The search engine offers a second possibility to access items. See figure 3 for a typical search request. With this request you obtain all the information about complexities for intuitionistic propositional logic IPC and the modal logic K. Because none of `Convention`, `Definition`, `Remark`, `Theorem` is selected, all of them match.



previous item next item S4: Provability LWBtheory home page

Item

S4: Provability

Definition: one–sided sequent calculus S4_$\mathcal{T}$

axioms:

- $P, \neg P$
- true

structural rules:

$$\frac{\Gamma}{A, \Gamma}\ (\textbf{weak})$$

logical rules:

$$\frac{A, \Gamma \quad B, \Gamma}{A \wedge B, \Gamma}\ (\wedge) \qquad \frac{A, B, \Gamma}{A \vee B, \Gamma}\ (\vee)$$

$$\frac{A, \Diamond\Gamma}{\Box A, \Diamond\Gamma}\ (\Box) \qquad \frac{A, \Diamond A, \Gamma}{\Diamond A, \Gamma}\ (\Diamond)$$

rewrite rules: RR_{nnf}

weak stands for weakening. If we apply one of the rewrite rules, then we write (rewr).

Example

S4_$\mathcal{T} \vdash \Box p$_1 $\rightarrow \Box\Box p$_1, as the following proof shows.

$$\cfrac{\cfrac{\cfrac{\cfrac{\cfrac{\cfrac{\neg p_1, p_1}{\Diamond\neg p_1, \neg p_1, p_1}\ (\textbf{weak})}{\Diamond\neg p_1, p_1}\ (\Diamond)}{\Diamond\neg p_1, \Box p_1}\ (\Box)}{\Diamond\neg p_1, \Box\Box p_1}\ (\Box)}{\Diamond\neg p_1 \vee \Box\Box p_1}\ (\vee)}{\Box p_1 \rightarrow \Box\Box p_1}\ (\textbf{rewr})$$

Author: AH

Fig. 2. A more complicated item. It shows the one-sided sequent calculus for the modal logic S4. Note the example of a typical proof in this calculus.

The quality of the presentation of the items is of course worse than a DVI file, but – in our opinion – it suffices for its purpose.

3 Available Information

The available information concerns some typical propositional logics and the propositional fragments of some well-known non-monotonic logics. At the moment, the following chapters exist:

1. intuitionistic propositional logic

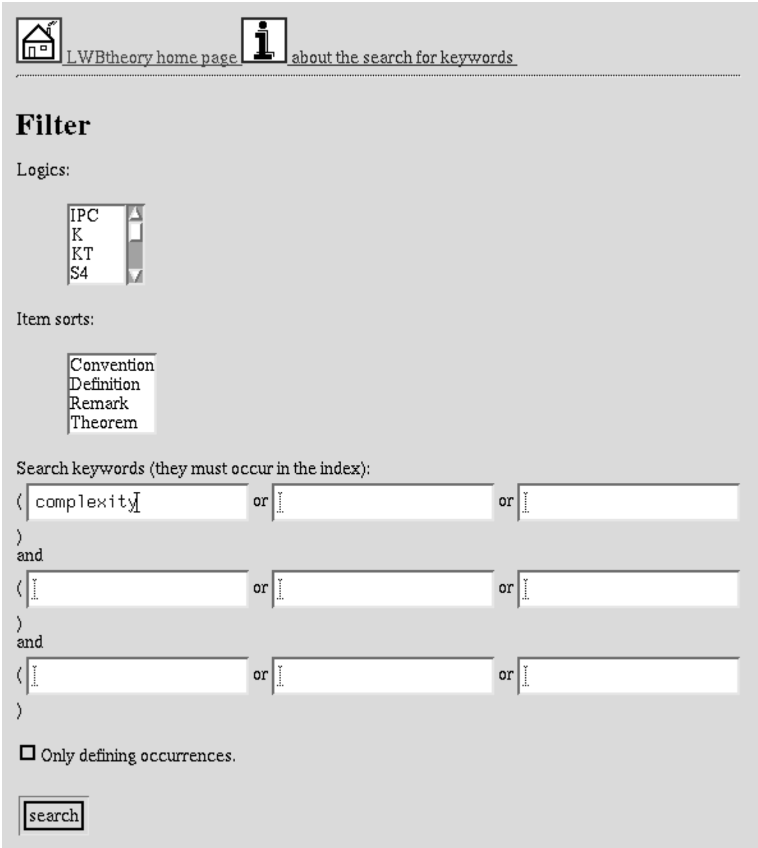


Fig. 3. A search request.

2. modal propositional logics K, KT, $\mathsf{S4}$, $\mathsf{S5}$, G
3. propositional circumscription
4. propositional closed world assumption
5. propositional default logic

Other chapters, e.g. one for the propositional tense logic K_t, are in preparation. The typical chapter about the modal logic $\mathsf{S4}$ consists of the following sections:

1. language
2. basic definitions
3. provability (several types of calculi and their properties)
4. Kripke semantics
5. embeddings
6. normal forms
7. backward proof search in sequent calculi

An important quality of LWBtheory is the uniform notation and presentation that makes a comparison of several logics much easier. Also for the sake of uniformity, each logic is completely described in its own chapter. Therefore the language for modal logics is repeated in the chapter about KT, although it is the same as in the chapter about K.
Each section consists of several items. Numerous examples facilitate the understanding of definitions, calculi and theorems. (For the moment there are no pointers to the literature. The author mentioned at the bottom of each page is just the person who typed in the item.)

Some typical questions that can be answered with the help of LWBtheory:

- Why is it not correct to omit the contraction in the left-implication rule of the standard sequent calculus for intuitionistic propositional logic ?
- What is the axiom of the Hilbert-type calculus that makes the difference between the modal logic K and the provability logic G ?
- How many modalities exist in the propositional modal logic S5 ?
- In circumscription, for every variable one has to decide whether one varies a variable, minimizes a variable, or does nothing with it. What is a typical example that shows the differences between these three possibilities ?

If you want to know whether $\leftrightarrow$ is associative in intuitionistic logic, or if you are too lazy to compute the negation normal form of the Peirce formula $((p_0 \to p_1) \to p_0) \to p_0$ in classical logic by hand, then LWBtheory cannot help. For such queries you can use its companion LWBinfo [1]. Open in your WWW browser `http://lwbwww.unibe.ch:8080/LWBinfo.html`, choose `run a session`, type in your request and push the send button. See figure 4 for an example.

4 Inside LWBtheory

The information contained in LWBtheory was written in LaTeX and afterwards automatically converted into HTML, using a self-developed Perl program. This Perl program creates not only HTML files from LaTeX files, but also generates the contents list (with links), the required GIF files, and the index for the search mechanism.
Using LaTeX gives the author the possibility to write things down 'as usual'. In addition, it is possible to make use of forthcoming extensions of HTML without changing the source. Of course there is a drawback. LaTeX is much more expressive than HTML, i.e. a lot of LaTeX elements have (until now) no counterpart in HTML. However, experience showed that it is often sufficient to replace some special symbols like Γ, $\Leftrightarrow$, $\mathcal{M}$ by small icons in order to obtain readable HTML documents. Large non-translatable parts like calculi and proofs are represented by GIF files. See section 2 for the advantages of these two sorts of icons. A few LaTeX elements (e.g. `_`, `^`) are shown as in the LaTeX source code.
For each item, the author has to give a list of keywords in the LaTeX source code. These keywords are then used by the search mechanism. Parts that should be represented in HTML as links are marked in the LaTeX source with a macro.

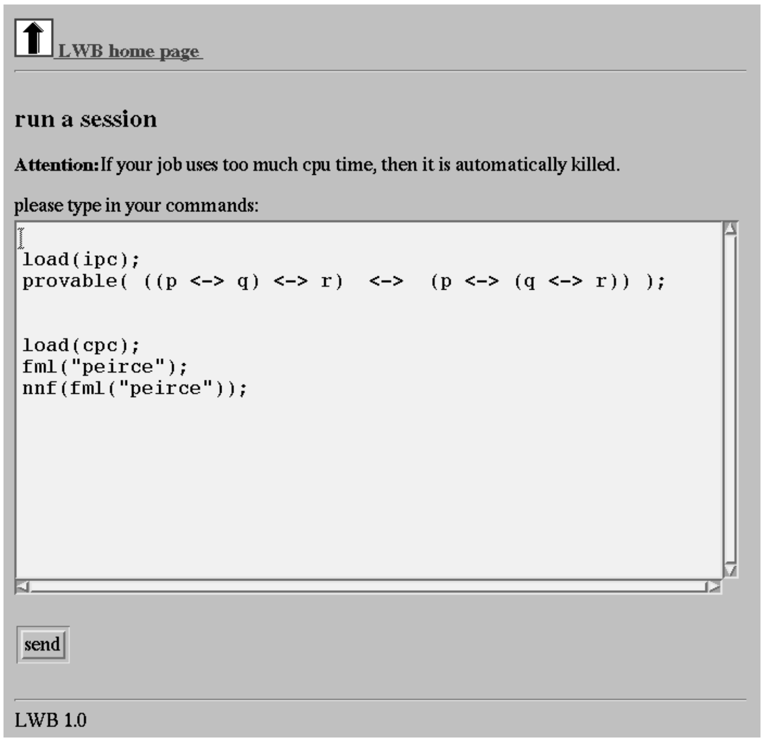


Fig. 4. A request to LWBinfo. For more difficult problems use the LWB programming language.

5 A Final Remark

If you want to know more about LWBtheory: just try. We would be grateful for reactions and comments (and also bug reports).

References

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