

Databases Homework 4

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Domain: Technology transfer, 42

Introduction:

This assignment delves into Full-Text Search using MySQL, aiming to gain practical experience in its implementation and utilization within a database system. The tasks include extending an existing database to enable full-text search functionality by creating an additional MyISAM table with text attributes for entity types and entities.

Initially, the additional table is populated with relevant textual data, ensuring a dataset of at least 20 entity names and corresponding descriptions for full-text searches. Following this, the MySQL server is configured to define a stop list, enhancing the accuracy and relevance of search results.

Subsequently, a full-text index is created for the additional MyISAM table, covering all text attributes needed for efficient retrieval of relevant information.

With the setup complete, different types of queries are elaborated upon. Firstly, three full-text search queries are developed in Natural Language Mode, and the top 20 results with the highest relevance are analyzed, showcasing the mode's effectiveness.

Next, Natural Language Mode with Query Expansion is experimented with, comparing results to evaluate the impact of query expansion on search results.

Finally, full-text search queries in Boolean Mode are explored, utilizing different operators to elaborate on three queries and report the top 20 results with the highest relevance, followed by an analysis of their accuracy and usefulness.

In conclusion, this assignment offers hands-on experience in implementing full-text search in a MySQL database, providing insights into the effectiveness and nuances of different search modes and techniques through query formulation and result analysis.

Step 1.0: Read the Methodological Guideline

Done

Step 1.1: Create an Additional MyISAM Table in Your DataBase

I'll create MyISAM table which will contain three columns: id, title and description.

Title will be briefly about something related to my domain (general things about entities e.g. Collaboration or some exact persons e.g. ManagerJames).

Description will provide a long natural text of description of the title.

Datatypes for ID will be int, for Title VARCHAR(256) – because it will have short text, for Description_title (TEXT) – long natural text of description.

```
CREATE TABLE IF NOT EXISTS technology_transfer_isam (  
  id int unsigned NOT NULL auto_increment,  
  title varchar(200) default NULL,  
  description_title text,  
  PRIMARY KEY (id)  
) ENGINE=MyISAM DEFAULT CHARSET=utf8mb4;
```

This is how I've created MyISAM table (technology_transfer_isam) for my domain.

Step 1.2: Populate Your Additional Table with Relevant Textual Data

Using following code

```
LOAD DATA INFILE 'D:/Programing/kurs 2/semester 2/databases/hw_4/MyISAM.csv' INTO TABLE technology_transfer_isam  
FIELDS TERMINATED BY ';'   
LINES TERMINATED BY '\n'  
IGNORE 1 LINES;
```

I've populated my table with titles and description_titles with natural language text

	id	title	description_title
▶	1	Collaboration	Collaboration is the cornerstone of innovation a...
	2	Customer	Customers are the lifeblood of any business, re...
	3	Director	Directors play a pivotal role in governance and l...
	4	Intellectual Property Office	Intellectual Property Offices serve as custodian...
	5	Intellectual Property Rights	Intellectual Property Rights encompass a spectr...
	6	Investor	Investors provide critical capital and financial su...
	7	License	Licenses are legal agreements that grant permis...
	8	Manager	Managers play a pivotal role in organizational ef...
	9	Organization Staff	Organization staff comprises the diverse workfo...
	10	Owner Organization	The owner organization is the entity or individu...
	11	Partnership Coordinator	Partnership Coordinators facilitate collaboration...
	12	Product	Products encompass a wide range of goods, ser...
	13	Receiver Organization	Receiver Organizations are entities or individual...
	14	Technology	Technology encompasses the tools, systems, a...
	15	Transfer Technology	Transfer Technology is the process of transferri...
	16	Worker	Workers are individuals employed to perform ta...
	17	Jeff Bezos Director	Jeff Bezos, the founder and former CEO of Am...
	18	Google LLC Owner Organiz...	Google LLC, a subsidiary of Alphabet Inc., is a t...
	19	International Monetary Fu...	The International Monetary Fund is an internati...
	20	Valve Corporation Owner ...	"Valve Corporation, founded in 1996 by former ...
	21	Amazon Owner Organization	Amazon.com, Inc., established by Jeff Bezos in ...
	22	Meta Platforms Inc Owner...	Meta Platforms, Inc. (formerly Facebook, Inc.) i...
	23	CRISPR-Cas9 Gene Editing...	Imagine a world where we can precisely edit ou...
	24	Soft Robotics Technology	Traditional rigid robots have limitations when it c...
	25	Quantum Dot Solar Cells T...	Conventional solar cells have made great stride...
	26	Oculus Rift Virtual Reality (...)	Step into the future with Oculus Rift, a groundb...
▲	NULL	NULL	NULL

Step 1.3: Create the Stop List of the Words that should not be Searched

I've created txt file with stop-words and using Server -> Options File -> MyISAM run MySQL workbench as Administrator and changed ft_stopword_file path

Fulltext search	
<input type="checkbox"/> ft_boolean_syntax	+ -<()~*:"'&
<input type="checkbox"/> ft_max_word_len	
<input type="checkbox"/> ft_min_word_len	4
<input type="checkbox"/> ft_query_expansion_limit	20
<input checked="" type="checkbox"/> ft_stopword_file	"D:/Programing/kours 2/semester 2/databases/hw_4/mysql_ft_stopword_file.txt"

After that, I've restarted MySQL server

All words: a, about, above, after, again, against, all, am, an, and, any, are, aren't, as, at, be, because, been, before, being, below, between, both, but, by, can, can't, cannot, could, couldn't, did, didn't, do, does, doesn't, doing, don't, down, during, each, few, for, from,

further, had, hadn't, has, hasn't, have, haven't, having, he, he'd, he'll, he's, her, here, here's, hers, herself, him, himself, his, how, how's, i, i'd, i'll, i'm, i've, if, in, into, is, isn't, it, it's, its, itself, let's, me, more, most, mustn't, my, myself, no, nor, not, of, off, on, once, only, or, other, ought, our, ours, ourselves, out, over, own, same, shan't, she, she'd, she'll, she's, should, shouldn't, so, some, such, than, that, that's, the, their, theirs, them, themselves, then, there, there's, these, they, they'd, they'll, they're, they've, this, those, through, to, too, under, until, up, very, was, wasn't, we, we'd, we'll, we're, we've, were, weren't, what, what's, when, when's, where, where's, which, while, who, who's, whom, why, why's, with, won't, would, wouldn't, you, you'd, you'll, you're, you've, your, yours, yourself, yourselves.

Step 1.4: Create the Full-Text Index

Using next code

```
ALTER TABLE technology_transfer_isam
ADD FULLTEXT INDEX ft1 (title, description_title),
ADD FULLTEXT INDEX ft2 (description_title);
```

I've created two full-text indexes: one for title and description_title columns and another for description_title column

```
SHOW INDEX FROM technology_transfer_isam;
```

Table	Non_unique	Key_name	Seq_in_index	Column_name	Collation	Cardinality	Sub_part	Packed	Null	Index_type	Comment	Index_comment	Visible	Expression
▶ technology_transfer_isam	0	PRIMARY	1	id	A	26	NULL	NULL		BTREE			YES	NULL
technology_transfer_isam	1	ft1	1	title	NULL	NULL	NULL	NULL	YES	FULLTEXT			YES	NULL
technology_transfer_isam	1	ft1	2	description_title	NULL	NULL	NULL	NULL	YES	FULLTEXT			YES	NULL
technology_transfer_isam	1	ft2	1	description_title	NULL	NULL	NULL	NULL	YES	FULLTEXT			YES	NULL

Step 1.5: Elaborate Queries IN NATURAL LANGUAGE MODE

In natural language mode the MySQL FULLTEXT search engine analyzes the relevance of search results based on several factors.

The relevance value is determined by two main criteria:

1. Proximity to the Beginning of Text: Words that appear closer to the beginning of the text are considered more relevant.

2. Frequency of Occurrence: The proportion of the number of occurrences of the searched word to the overall number of words in the field also influences relevance. If the word appears multiple times within the field, its relevance is higher.

It's important to note the "50% threshold" rule in natural language mode. If a word occurs in more than 50% of all the fields under FULLTEXT search, the search results for this word will be returned. This threshold helps prevent overly common words from dominating search results.

1.) 'Technology innovation'

```
• SELECT *, MATCH(title, description_title) AGAINST('technology innovation' IN  
  NATURAL LANGUAGE MODE) AS relevance  
  FROM technology_transfer_isam  
  WHERE MATCH(title, description_title) AGAINST('technology innovation' IN NATURAL  
    LANGUAGE MODE) order by relevance  
  DESC;
```

Finding in natural language mode words 'technology innovation' gives the highest relevance for IPO and IPR. It means that many times this words were reaped in both of these description_titles. It obvious for next rows that their relevance will be higher because most of them using in description_titles when the language comes to providing and developing new innovative technologies (collaboration with organizations, Google Inc, etc.). Also some rows for which words are met in column title also (technology, technology transfer) are not in the top because has less containing words of this phrase in description_title.

	id	title	description_title	relevance
▶	4	Intellectual Property Office	Intellectual Property Offices serve as custodian...	0.3230510950088501
	5	Intellectual Property Rights	Intellectual Property Rights encompass a spectr...	0.3170744478702545
	18	Google LLC Owner Organization	Google LLC, a subsidiary of Alphabet Inc., is a t...	0.21229074895381927
	14	Technology	Technology encompasses the tools, systems, a...	0.20971861481666565
	1	Collaboration	Collaboration is the cornerstone of innovation a...	0.20823818445205688
	11	Partnership Coordinator	Partnership Coordinators facilitate collaboration...	0.2047162801027298
	7	License	Licenses are legal agreements that grant permis...	0.19941401481628418
	6	Investor	Investors provide critical capital and financial su...	0.1956120878458023
	12	Product	Products encompass a wide range of goods, ser...	0.19136349856853485
	15	Transfer Technology	Transfer Technology is the process of transferi...	0.18217633664608002
	21	Amazon Owner Organization	Amazon.com, Inc., established by Jeff Bezos in ...	0.1746082603931427

2.) 'Product development'

```
• SELECT *, MATCH(title, description_title) AGAINST('product development' IN  
  NATURAL LANGUAGE MODE) AS relevance  
  FROM technology_transfer_isam  
  WHERE MATCH(title, description_title) AGAINST('product development' IN NATURAL  
    LANGUAGE MODE) order by relevance  
  DESC;
```

Next was searching 'product development' phrase. Interesting, that product title isn't the highest one. The highest relevance is for Customer because in description_title many times word product was used. Also, for next row, the 'product' word is in title. For Valve corporation, this organization developed gaming platform – Steam – it is product development and was mentioned in description_title. Worker also develops products in some sense so it is displayed.

	id	title	description_title	relevance
*	2	Customer	Customers are the lifeblood of any business, re...	3.103170871734619
	12	Product	Products encompass a wide range of goods, ser...	2.595883369445801
	20	Valve Corporation Owner Organization	"Valve Corporation, founded in 1996 by former ...	2.1619279384613037
	16	Worker	Workers are individuals employed to perform ta...	1.296543836593628

3.) 'Organization agreements'

```
• SELECT *, MATCH(title, description_title) AGAINST('organization agreements' IN  
  NATURAL LANGUAGE MODE) AS relevance  
  FROM technology_transfer_isam  
  WHERE MATCH(title, description_title) AGAINST('organization agreements' IN NATURAL  
    LANGUAGE MODE) order by relevance  
  DESC;
```

For phrase 'organization agreements' the highest relevance gives for license because in description_title states that license secures agreements between organizations and so on. For second row, it has in description_title a lot of relevant information about this phrase. Next all entities, except transfer technology are organizations or parts of organizations containing in title word 'organization'. Transfer technology also has in description_title relevance about transferring between receiver and owner organizations. In other words, the phrase is overlapping.

id	title	description_title	relevance
7	License	Licenses are legal agreements that grant permis...	2.7050905227661133
11	Partnership Coordinator	Partnership Coordinators facilitate collaboration...	1.6401506662368774
10	Owner Organization	The owner organization is the entity or individu...	1.006300687789917
9	Organization Staff	Organization staff comprises the diverse workfo...	0.9678563475608826
15	Transfer Technology	Transfer Technology is the process of transferri...	0.6324955224990845
18	Google LLC Owner Organization	Google LLC, a subsidiary of Alphabet Inc., is a t...	0.4353131949901581
19	International Monetary Fund Receiver Organiza...	The International Monetary Fund is an internati...	0.41215980052948
13	Receiver Organization	Receiver Organizations are entities or individual...	0.4104801416397095
20	Valve Corporation Owner Organization	"Valve Corporation, founded in 1996 by former ...	0.39868515729904175
21	Amazon Owner Organization	Amazon.com, Inc., established by Jeff Bezos in ...	0.3580433130264282
22	Meta Platforms Inc Owner Organization	Meta Platforms, Inc. (formerly Facebook, Inc.) i...	0.3410649299621582

Step 1.6: Elaborate Queries IN NATURAL LANGUAGE MODE WITH QUERY EXPANSION

This mode, also known as "WITH QUERY EXPANSION," aims to enhance the recall of search results. However, it's not recommended for large datasets as it may yield numerous irrelevant or less relevant rows, thus reducing precision. Full-text search functionality supports query expansion, including its variant known as "blind query expansion." This feature proves especially beneficial when a search phrase is too brief, indicating that the user relies on implicit knowledge not captured by the full-text search engine. It operates by conducting the search twice, with the second search phrase being the original one concatenated with the most relevant documents from the initial search.

1.) 'Technology innovation'

```

• SELECT *, MATCH(title, description_title) AGAINST('technology innovation' WITH
  QUERY EXPANSION) AS relevance
  FROM technology_transfer_isam
  WHERE MATCH(title, description_title) AGAINST('technology innovation' WITH QUERY
    EXPANSION) order by relevance
  DESC
  LIMIT 20;

```

Top three rows has changed because this mode increases chances of finding conceptually similar words. And it turns out that this new three rows has more relevance in description_titles. Also there are a lot of new rows (>20) because this mode include additional terms which are connected to original.

	id	title	description_title	relevance
►	22	Meta Platforms Inc Owner Organization	Meta Platforms, Inc. (formerly Facebook, Inc.) i...	211.13587951660156
	25	Quantum Dot Solar Cells Technology	Conventional solar cells have made great stride...	207.20077514648438
	26	Oculus Rift Virtual Reality (VR) Technology	Step into the future with Oculus Rift, a groundb...	202.94712829589844
	5	Intellectual Property Rights	Intellectual Property Rights encompass a spectr...	185.49588012695312
	4	Intellectual Property Office	Intellectual Property Offices serve as custodian...	176.33055114746094
	24	Soft Robotics Technology	Traditional rigid robots have limitations when it c...	175.38685607910156
	21	Amazon Owner Organization	Amazon.com, Inc., established by Jeff Bezos in ...	168.1107177734375
	7	License	Licenses are legal agreements that grant permis...	167.22157287597656
	23	CRISPR-Cas9 Gene Editing Technology	Imagine a world where we can precisely edit ou...	162.32266235351562
	15	Transfer Technology	Transfer Technology is the process of transferri...	143.97869873046875
	11	Partnership Coordinator	Partnership Coordinators facilitate collaboration...	130.54586791992188
	1	Collaboration	Collaboration is the cornerstone of innovation a...	129.5790557861328
	6	Investor	Investors provide critical capital and financial su...	129.4044952392578
	12	Product	Products encompass a wide range of goods, ser...	123.27421569824219
	17	Jeff Bezos Director	Jeff Bezos, the founder and former CEO of Am...	118.10130310058594
	18	Google LLC Owner Organization	Google LLC, a subsidiary of Alphabet Inc., is a t...	116.18228912353516
	14	Technology	Technology encompasses the tools, systems, a...	109.38337707519531
	13	Receiver Organization	Receiver Organizations are entities or individual...	103.47186279296875
	10	Owner Organization	The owner organization is the entity or individu...	101.73271179199219
	2	Customer	Customers are the lifeblood of any business, re...	65.3792495727539

2.) 'Product development'

```
• SELECT *, MATCH(title, description_title) AGAINST('product development' WITH  
  QUERY EXPANSION) AS relevance  
  FROM technology_transfer_isam  
  WHERE MATCH(title, description_title) AGAINST('product development' WITH QUERY  
    EXPANSION) order by relevance  
  DESC  
  LIMIT 20;
```

For product development, the top four rows are stayed the same but swapped. Also were added new rows but with very small relevance because of similar related words to original ones.

	id	title	description_title	relevance
▶	12	Product	Products encompass a wide range of goods, ser...	111.48855590820312
	20	Valve Corporation Owner Organization	"Valve Corporation, founded in 1996 by former ...	108.38970184326172
	16	Worker	Workers are individuals employed to perform ta...	103.7916030883789
	2	Customer	Customers are the lifeblood of any business, re...	102.53922271728516
	21	Amazon Owner Organization	Amazon.com, Inc., established by Jeff Bezos in ...	26.20140266418457
	22	Meta Platforms Inc Owner Organization	Meta Platforms, Inc. (formerly Facebook, Inc.) i...	15.167720794677734
	15	Transfer Technology	Transfer Technology is the process of transferri...	14.83504867553711
	13	Receiver Organization	Receiver Organizations are entities or individual...	14.289097785949707
	18	Google LLC Owner Organization	Google LLC, a subsidiary of Alphabet Inc., is a t...	12.221786499023438
	9	Organization Staff	Organization staff comprises the diverse workfo...	9.546359062194824
	1	Collaboration	Collaboration is the cornerstone of innovation a...	8.218191146850586
	3	Director	Directors play a pivotal role in governance and l...	7.950979709625244
	6	Investor	Investors provide critical capital and financial su...	7.063675403594971
	11	Partnership Coordinator	Partnership Coordinators facilitate collaboration...	6.809852600097656
	23	CRISPR-Cas9 Gene Editing Technology	Imagine a world where we can precisely edit ou...	6.038265228271484
	26	Oculus Rift Virtual Reality (VR) Technol...	Step into the future with Oculus Rift, a groundb...	5.675993919372559
	10	Owner Organization	The owner organization is the entity or individu...	5.615643501281738
	24	Soft Robotics Technology	Traditional rigid robots have limitations when it c...	4.779984474182129
	14	Technology	Technology encompasses the tools, systems, a...	4.419939041137695
	8	Manager	Managers play a pivotal role in organizational ef...	4.192107677459717

3.) 'Organization agreements'

```
• SELECT *, MATCH(title, description_title) AGAINST('organization agreements' WITH  
  QUERY EXPANSION) AS relevance  
  FROM technology_transfer_isam  
  WHERE MATCH(title, description_title) AGAINST('organization agreements' WITH QUERY  
    EXPANSION) order by relevance  
  DESC  
  LIMIT 20;
```

The initiative in the top by relevance was taken over by titles with 'organization' word in them. It also notably, that because of this mode which captures relevant texts which do not contain exact phrases, new rows were appeared.

id	title	description_title	relevance
22	Meta Platforms Inc Owner Organization	Meta Platforms, Inc. (formerly Facebook, Inc.) i...	164.34474182128906
21	Amazon Owner Organization	Amazon.com, Inc., established by Jeff Bezos in ...	137.3815460205078
20	Valve Corporation Owner Organization	"Valve Corporation, founded in 1996 by former ...	119.89022064208984
9	Organization Staff	Organization staff comprises the diverse workfo...	119.53253936767578
15	Transfer Technology	Transfer Technology is the process of transferi...	115.3244857788086
19	International Monetary Fund Receiver Organiza...	The International Monetary Fund is an internati...	108.12104797363281
11	Partnership Coordinator	Partnership Coordinators facilitate collaboration...	106.70975494384766
7	License	Licenses are legal agreements that grant permis...	105.8840103149414
18	Google LLC Owner Organization	Google LLC, a subsidiary of Alphabet Inc., is a t...	101.97509765625
10	Owner Organization	The owner organization is the entity or individu...	97.34009552001953
13	Receiver Organization	Receiver Organizations are entities or individual...	91.53797149658203
1	Collaboration	Collaboration is the cornerstone of innovation a...	47.51300811767578
2	Customer	Customers are the lifeblood of any business, re...	39.73330307006836
26	Oculus Rift Virtual Reality (VR) Technology	Step into the future with Oculus Rift, a groundb...	37.97201919555664
17	Jeff Bezos Director	Jeff Bezos, the founder and former CEO of Am...	37.660160064697266
12	Product	Products encompass a wide range of goods, ser...	36.51542663574219
4	Intellectual Property Office	Intellectual Property Offices serve as custodian...	34.45719528198242
8	Manager	Managers play a pivotal role in organizational ef...	32.62809753417969
5	Intellectual Property Rights	Intellectual Property Rights encompass a spectr...	32.18331527709961
6	Investor	Investors provide critical capital and financial su...	30.637609481811523

Overall, this mode uses synonyms, related words to improve mismatching when users do not enter exact phrases or words. It helps also when clients are not familiar with vocabulary in some part of science. It brings good experiences by searching for broader information and texts which have many in common to the original phrase.

Step 1.7: Elaborate Queries IN BOOLEAN MODE

In this mode, the relevance of a word is computed differently wrt the IN NATURAL LANGUAGE MODE. It is a conditional measure of correspondence to the given pattern. The offset of the searched pattern from the beginning of the text and the number of found occurrences do not matter. An important particularity of this mode is the possibility of using logical operators

1.) '+technology -innovation'

```
• SELECT *, MATCH(title, description_title) AGAINST('+technology -innovation' IN
  BOOLEAN MODE) AS relevance
  FROM technology_transfer_isam
  WHERE MATCH(title, description_title) AGAINST('+technology -innovation' IN
  BOOLEAN MODE) order by relevance
  DESC
  LIMIT 20;
```

Here I've got all rows that contain technology but without word innovation.

	id	title	description_title	relevance
▶	10	Owner Organization	The owner organization is the entity or individu...	1
	13	Receiver Organization	Receiver Organizations are entities or individual...	1
	17	Jeff Bezos Director	Jeff Bezos, the founder and former CEO of Am...	1
	22	Meta Platforms Inc Owner Organization	Meta Platforms, Inc. (formerly Facebook, Inc.) i...	1
	23	CRISPR-Cas9 Gene Editing Technology	Imagine a world where we can precisely edit ou...	1
	24	Soft Robotics Technology	Traditional rigid robots have limitations when it c...	1
	25	Quantum Dot Solar Cells Technology	Conventional solar cells have made great stride...	1
	26	Oculus Rift Virtual Reality (VR) Technology	Step into the future with Oculus Rift, a groundb...	1

2.) 'develop*'

```
1 • SELECT *, MATCH(title, description_title) AGAINST('develop*' IN
2   BOOLEAN MODE) AS relevance
3   FROM technology_transfer_isam
4   WHERE MATCH(title, description_title) AGAINST('develop*' IN
5     BOOLEAN MODE) order by relevance
6   DESC
7   LIMIT 20;
8
9
```

Here are present all rows which contains word 'develop' itself and also 'developer', 'developing', 'developed' and ones which part starts on 'develop'.

	id	title	description_title	relevance
▶	26	Oculus Rift Virtual Reality (VR) Technology	Step into the future with Oculus Rift, a groundb...	1
	23	CRISPR-Cas9 Gene Editing Technology	Imagine a world where we can precisely edit ou...	1
	2	Customer	Customers are the lifeblood of any business, re...	1
	16	Worker	Workers are individuals employed to perform ta...	1
	20	Valve Corporation Owner Organization	"Valve Corporation, founded in 1996 by former ...	1

3.) '+collaboration +(>terms <agreements)'

Find rows that contain the words 'collaboration' and 'terms', or 'collaboration' and 'agreements' (in any order), but rank 'collaboration terms' higher than 'collaboration agreements'. And this is logical, since not many rows contains combinations of these words. (In license may be provided collaboration terms also including technology usage and in partnership coordinator is more about collaboration agreements and negotiations)

	id	title	description_title	relevance
▶	7	License	Licenses are legal agreements that grant permis...	1.3333333730697632
	11	Partnership Coordinator	Partnership Coordinators facilitate collaboration...	0.8333333730697632

```
• SELECT *, MATCH(title, description_title) AGAINST('+collaboration +(>terms <agreements)' IN  
  BOOLEAN MODE) AS relevance  
  FROM technology_transfer_isam  
  WHERE MATCH(title, description_title) AGAINST('+collaboration +(>terms <agreements)' IN  
    BOOLEAN MODE) order by relevance  
  DESC  
  LIMIT 20;
```

Step 1.8: Conclude Your Report

In this assignment I use the MyISAM table and MySQL's full-text search feature, highlighting their roles and advantages in database environments. MyISAM table offer efficient storage for read-heavy workloads and support full-text search functionality. MySQL's full-text search feature is robust, with options like NATURAL LANGUAGE MODE, BOOLEAN MODE, and QUERY EXPANSION, each catering to different precision levels in search queries. What I've done before querying is next:

- 1.) Created technology_transfer_isam table
- 2.) Populated this table with natural-language texts
- 3.) Create list of stopwords and change configuration of MySQL server
- 4.) Created two indexes for full-text search (first is for title and description_title and second one is for description_title)

For next three types of full-text searches I've made for three queries per each mode of full-text search.

NATURAL LANGUAGE MODE simplifies search by allowing users to input queries in plain language. It's ideal for general-purpose searching but lacks fine-grained control and may not always deliver precise results.

NATURAL LANGUAGE MODE WITH QUERY EXPANSION broadens search scope by including related terms, useful when synonyms or variations of search terms are relevant. However, it can sometimes introduce noise in results.

BOOLEAN MODE offers precise control over search terms and combinations using operators. It's suitable for advanced search scenarios but requires users to construct queries using specific syntax, making it less user-friendly for those unfamiliar with Boolean logic.

I've made codes that was used for queries and corresponding results, describing differences and interesting outcomes.

For me, this assignment was one of the most interesting because it is really important nowadays because of full-text search methods are using everywhere and be acknowledged with these modes are very useful and curios for me. This homework gave me knowledge about search modes in databases, which will definitely help me in the future, because I will already know in general how and when to use a certain mode, what it gives, and what it is needed for.

Also thank you for the course and really useful and practical homeworks which develop the skills to actually create (for example, the first design) and further improve and update it using practical skills!