# INF8460_A24_TP1_Presley-Ibrahima-Lucie

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**INF8460 − Traitement automatique de la langue naturelle - Automne 2024**

### 0.0.1 TP1 - Recherche de documents avec une métrique de similarité

## 0.1 Identification de l'équipe:

### 0.1.1 Groupe de laboratoire:

### 0.1.2 Equipe numéro :

### 0.1.3 Membres:

- Lucie Legarez 2413157 (1/3 de contribution, Traitement et prétraitement des données, Graphique BM25 / TF_IDF)
- Gervais Presley Koyaweda 2305686 (1/3 de contribution, Traitement des données, Creation des différentes fonctions de prétraitement, Mise en place du BM25)
- Ibrahima Ba 1943223 (1/3 de contribution, Traitement et Prétraitement des données, Optimisation des scripts, Observations BM25 et Commentaires)

**Le TP s'est fait de façon indépendante avec comme objectif de comparer nos différents résultats et de choisir les scipts les plus simples et rapide à chaque étape. Tous les membres de l'équipe ont travaillé sur chacune des 3 parties et les efforts fournis ont été équitables.**

- nature de la contribution: Décrivez brièvement ce qui a été fait par chaque membre de l'équipe. Tous les membres sont censés contribuer au développement. Bien que chaque membre puisse effectuer différentes tâches, vous devez vous efforcer d'obtenir une répartition égale du travail. Soyez précis ! N'indiquez pas seulement : travail réparti équitablement

## 0.2 Mise en place

### 0.2.1 Objectif du TP

La recherche d'information est le processus d'accès aux données, généralement des documents ou d'autres données non structurées, à partir d'une requête. Dans ce TP, vous aurez en entrée une requête textuelle sous forme d'affirmation. Il faudra retrouver dans un corpus de littérature scientifique les documents pertinents qui justifient ou infirment la véracité de cette affirmation. Vous utiliserez des modèles vectoriels et des métriques de similarité pour cette tâche.

### 0.2.2 Jeux de données

Dans ce TP, vous utiliserez le jeu de données dans le répertoire *data*. Il s'agit d'un ensemble de données comprenant 809 affirmations rédigées par des experts et 5183 documents de références pour ces affirmations. Ces documents contiennent des phrases qui confirment ou infirment (contredisent) les affirmations. L'objectif est donc de trouver un document pertinent, c'est-à-dire contenant la ou les phrases qui permettent d'évaluer une affirmation donnée en entrée en utilisant une similarité sémantique.

Le jeu de données comprend :

1. Un corpus (*corpus.jsonl*) qui contient des documents décrits avec les informations suivantes :
   - 'doc_id' : permet d'identifier le document en entrée
   - 'title' : donne le titre du document
   - 'abstract': est le résumé du document
   - 'structured': indique si le document est structuré ou pas
2. Un ensemble d'affirmations (*claims.jsonl*) qui contient des documents décrits avec les informations suivantes :
   - 'id' : identifie l'affirmation.
   - 'claim' : est l'affirmation en tant que telle.
   - 'evidence' : précise quelles phrases du document sont pertinentes pour l'affirmation. Chaque phrase est accompagnée d'une étiquette de véracité (confirm/contradict) pour indiquer si la phrase confirme ou contredit l'affirmation.

   - 'cited_doc_ids' : indique les identifiants des documents cités.

Dans *claims.jsonl*, seuls les identifiants des documents sont renseignés. Pour avoir les détails d'un document tel que le titre ("title") et le résumé ("abstract"), il faudra consulter le fichier *corpus.jsonl*.

Voici un exemple :

- **Affirmation (claim)** : Consumption of whole fruits increases the risk of type 2 diabetes.

- **Cited document(s) ID(s)** : 1974176

- **Evidence (sentence in the document containing the proof)** : [{'sentences': [11], 'label': 'CONTRADICT'}]

  Ici [11] constitue le numéro de la phrase qui contredit l'affirmation.

- **Cited document(s) title(s)** : Fruit consumption and risk of type 2 diabetes: results from three prospective longitudinal cohort studies

- **Cited document(s) abstract(s) (list of sentences)** :

  – [0] 'OBJECTIVE To determine whether individual fruits are differentially associated with risk of type 2 diabetes.'
  – [1] 'DESIGN Prospective longitudinal cohort study.'
  – …
  – [10] 'CONCLUSION Our findings suggest the presence of heterogeneity in the associations between individual fruit consumption and risk of type 2 diabetes.'
  – [11] 'Greater consumption of specific whole fruits, particularly blueberries, grapes, and apples, is significantly associated with a lower risk of type 2 diabetes, whereas greater

consumption of fruit juice is associated with a higher risk.'

Le champ "evidence" indique la phrase au niveau du résumé du document qui confirme ou infirme l'affirmation, d'où le numéro de la phrase et le label qui y sont renseignés. Dans le cas particulier de l'exemple ci-dessus, on voit bien que la onzième phrase du résumé du document est la plus pertinente pour l'affirmation et qu'elle la contredit, ce qui explique le label "CONTRADICT" dans "evidence". Cependant, dans le cadre de ce TP, on ne s'intéresse qu'à la présence de cette phrase pertinente dans le document, donc on ne considérera pas cette colonne "evidence" dans la suite du TP.

### 0.2.3 Librairies permises

- Jupyter notebook
- NLTK
- Numpy
- Pandas
- Sklearn
- PowerLaw
- Matplotlib
- TQDM
- BM25
- Pour toute autre librairie, demandez à votre chargé de laboratoire

## 0.3 Étapes du TP

A partir du notebook *INF8460_A24_TP1* qui est distribué, vous devez réaliser les étapes suivantes. (Notez que les cellules dans le squelette sont là à titre informatif - il est fort probable que vous rajoutiez des sections au fur et à mesure de votre TP).

```python
[1]: # Lien vers les fichiers à utiliser
     # Ne pas modifier

     PATH = 'data/ai2_data/'
```

```python
[2]: #!pip install rank_bm25
     #!pip install powerlaw
```

```python
[3]: # Import des librairies

     import numpy as np
     import pandas as pd
     import powerlaw
     import json
     from collections import defaultdict, Counter
     from tqdm import tqdm
     import matplotlib.pyplot as plt
     from typing import List, Dict
     %config InlineBackend.figure_format = 'retina'
```

```python
import nltk
from nltk.tokenize import word_tokenize
from nltk.stem.porter import PorterStemmer
from nltk.corpus import stopwords
import string
from string import punctuation
from tabulate import tabulate

import sklearn
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.metrics.pairwise import cosine_similarity

from rank_bm25 import BM25Okapi
```

```python
[4]: nltk.download('punkt')
     nltk.download('stopwords')
     stop_words = set(stopwords.words('english'))
```

```
[nltk_data] Downloading package punkt to
[nltk_data]     /Users/ibrahimaba/nltk_data…
[nltk_data]   Package punkt is already up-to-date!
[nltk_data] Downloading package stopwords to
[nltk_data]     /Users/ibrahimaba/nltk_data…
[nltk_data]   Package stopwords is already up-to-date!
```

#### 0.3.1 1. Traitement des données (15 points)

Vous allez effectuer une analyse afin d'avoir une idée claire des données que vous aurez à manipuler.

**1.1 Chargement des données (2 points)**

**1.1.1 Chargement et affichage des données (1 point)**   Chargez les données '*claims.jsonl*' et '*corpus.jsonl*' puis affichez-les dans des dataframes en utilisant panda.

```python
[5]: # Lecture des donnees

     df_claims = pd.read_json(PATH + "claims.jsonl", lines=True)
     df_corpus = pd.read_json(PATH + "corpus.jsonl", lines=True)
```

```python
[6]: # Affichage de df_claims

     df_claims
```

```
[6]:      id                                          claim  \
     0     0  0-dimensional biomaterials lack inductive prop…
     1     2  1 in 5 million in UK have abnormal PrP positiv…
     2     4  1-1% of colorectal cancer patients are diagnos…
     3     6  10% of sudden infant death syndrome (SIDS) dea…
```

```
4         9   32% of liver transplantation programs required…
..        …                                                  …
804    1403   siRNA knockdown of A20 accelerates tumor progr…
805    1404   siRNA knockdown of A20 slows tumor progression…
806    1405   taa1 tar1 tar2 triple mutants in Arabidopsis d…
807    1406    -sheet opening occurs during pleurotolysin po…
808    1407                   1/Ketel is able to bind microtubules.

                                          evidence          cited_doc_ids
0                                               {}            [31715818]
1     {'13734012': [{'sentences': [4], 'label': 'CON…          [13734012]
2                                               {}            [22942787]
3                                               {}             [2613775]
4     {'44265107': [{'sentences': [15], 'label': 'SU…          [44265107]
..                                               …                    …
804   {'33370': [{'sentences': [6], 'label': 'CONTRA…     [33370, 38355793]
805   {'33370': [{'sentences': [6], 'label': 'SUPPOR…     [33370, 38355793]
806                                             {}            [10504681]
807   {'2617858': [{'sentences': [4], 'label': 'SUPP…           [2617858]
808                                             {}   [8087082, 29863668]

[809 rows x 4 columns]
```

[7]: ```python
# Affichage de df_corpus

df_corpus
```

[7]:
```
         doc_id                                           title  \
0          4983   Microstructural development of human newborn c…
1          5836   Induction of myelodysplasia by myeloid-derived…
2          7912   BC1 RNA, the transcript from a master gene for…
3         18670   The DNA Methylome of Human Peripheral Blood Mo…
4         19238   The human myelin basic protein gene is include…
…            …                                               …
5178  195689316   Body-mass index and cause-specific mortality i…
5179  195689757   Targeting metabolic remodeling in glioblastoma…
5180  196664003   Signaling architectures that transmit unidirec…
5181  198133135   Association between pre-diabetes, type 2 diabe…
5182  198309074   Adhesion molecules and chemokines: relation to…

                                          abstract   structured
0      [Alterations of the architecture of cerebral w…        False
1      [Myelodysplastic syndromes (MDS) are age-depen…        False
2      [ID elements are short interspersed elements (…        False
3      [DNA methylation plays an important role in bi…        False
4      [Two human Golli (for gene expressed in the ol…        False
…                                               …            …
```

```
5178   [BACKGROUND The main associations of body-mass…        True
5179   [A key aberrant biological difference between …        False
5180   [A signaling pathway transmits information fro…        False
5181   [AIMS Trabecular bone score (TBS) is a surroga…        True
5182   [Introduction: Among the inflammatory mediator…        False

[5183 rows x 4 columns]
```

**1.1.2 Statistique sur les évidences (1 point)** Calculez les pourcentages d'apparition de chaque label des évidences dans "*df_claims*" (CONTRADICT ou SUPPORT). Pour rappel les évidences sont les extraits pertinents des résumés qui supportent ou contredisent les affirmations.

```
[8]:  # Fonction d'extraction des labels de chaque evidence


      def extract_label(evidence):
          return [evidence.get('label') for doc_id, evidences in evidence.items() for␣
       ↪evidence in evidences]

      # Application de la fonction à notre df pour extraire les labels dans une␣
       ↪nouvelle colonne
      all_labels = df_claims['evidence'].apply(lambda x: extract_label(x)).explode()

      # On compte chaque label
      label_counts = all_labels.value_counts()

      # Calcul du pourcentage de chaque label
      label_percentages = (label_counts / label_counts.sum()) * 100

      # Arrondi du pourcentage à 2 chiffres après la virgule
      label_percentages = label_percentages.round(2)

      # Ajout du symbole de pourcentage
      label_percentages = label_percentages.astype(str) + '%'

      label_percentages
```

```
[8]:  evidence
      SUPPORT        64.37%
      CONTRADICT     35.63%
      Name: count, dtype: object
```

Réponse attendue:

CONTRADICT: 35.63%

SUPPORT: 64.37%

**1.2 Analyse statistique des données (7 points)** Nous allons faire une suite de transformations sur les données pour les rendre plus faciles à manipuler.

**1.2.1 Implémentation de la fonction "*list_to_string*"** Nous mettons à votre disposition la fonction "*list_to_string*" qui transforme une liste de phrases en un texte en les concaténant et enlèvant tous les caractères de nouvelle ligne (\n) pour s'assurer que nous avons un texte complet.

```python
[9]: # On transforme la liste de phrases en un texte


def list_to_string(x):
    if isinstance(x, list):
        return ' '.join(str(i).replace("\n","").replace("  "," ") for i in x)
    return str(x)
```

**1.2.2 Utilisation de la fonction "*list_to_string*"** Appliquons cette fonction "*list_to_string*" aux colonnes "*title*" et "abstract" du dataframe "*df_corpus*".

```python
[10]: # On applique la fonction aux colonnes "title" et "abstract"


df_corpus['title']    = df_corpus['title'].apply(list_to_string)
df_corpus['abstract'] = df_corpus['abstract'].apply(list_to_string)
```

**1.2.3 Ajout de la colonne "*text*" dans "df_corpus"** Ajoutons maintenant une colonne "*text*" qui est la concaténation du titre ("*title*") et du résumé ("*abstract*") au niveau du dataframe "df_corpus".

```python
[11]: # On concatene les textes dans "title" et "abstract"


df_corpus['text'] = df_corpus['title'] + " " + df_corpus['abstract']
```

**1.2.4 Ajout de colonnes dans "*df_claims*" (1 point)** Ajoutez les colonnes "*claim_length*" et "*num_cited_doc*" qui donnent, pour chaque affirmation, le nombre de mots dans la colonne "*claim*" et le nombre de documents cités au niveau de la colonne "*cited_doc_ids*" pour le dataframe "*df_claims*". Vous pouvez considérer que des mots sont simplement une séquence de caractères séparés par un espace.

```python
[12]: # Fonction pour compter le nombre de mots dans une chaîne de caractères
def count_words(text):
    return len(str(text).split())

# Fonction pour compter le nombre d'éléments dans une liste
def count_elements_list(liste):
    if isinstance(liste, list):
        return len(liste)
    else:
        return 0

# Ajout de la colonne "claim_length" qui compte le nombre de mots dans la␍
 ↪colonne "claim"
df_claims["claim_length"] = df_claims["claim"].apply(count_words)
```

```
# Ajout de la colonne "num_cited_doc" qui compte le nombre de documents cités␣
  ↪dans "cited_doc_ids"
df_claims["num_cited_doc"] = df_claims["cited_doc_ids"].
  ↪apply(count_elements_list)
```

[13]: df_claims

[13]:         id                                              claim  \
      0        0  0-dimensional biomaterials lack inductive prop…
      1        2  1 in 5 million in UK have abnormal PrP positiv…
      2        4  1-1% of colorectal cancer patients are diagnos…
      3        6  10% of sudden infant death syndrome (SIDS) dea…
      4        9  32% of liver transplantation programs required…
      ..     …                                                  …
      804   1403  siRNA knockdown of A20 accelerates tumor progr…
      805   1404  siRNA knockdown of A20 slows tumor progression…
      806   1405  taa1 tar1 tar2 triple mutants in Arabidopsis d…
      807   1406   -sheet opening occurs during pleurotolysin po…
      808   1407              1/Ketel is able to bind microtubules.

                                              evidence        cited_doc_ids  \
      0                                             {}         [31715818]
      1    {'13734012': [{'sentences': [4], 'label': 'CON…         [13734012]
      2                                             {}         [22942787]
      3                                             {}          [2613775]
      4    {'44265107': [{'sentences': [15], 'label': 'SU…         [44265107]
      ..                                              …                  …
      804  {'33370': [{'sentences': [6], 'label': 'CONTRA…    [33370, 38355793]
      805  {'33370': [{'sentences': [6], 'label': 'SUPPOR…    [33370, 38355793]
      806                                           {}         [10504681]
      807  {'2617858': [{'sentences': [4], 'label': 'SUPP…          [2617858]
      808                                           {}   [8087082, 29863668]

           claim_length  num_cited_doc
      0               5              1
      1              10              1
      2              12              1
      3              16              1
      4              13              1
      ..              …              …
      804            14              2
      805            14              2
      806            14              1
      807             7              1
      808             6              2
```

```
[809 rows x 6 columns]
```

**1.2.5 Ajout des colonnes de mesures de longeurs de textes (documents) (1 point)**
Ajoutez les colonnes "*title_length*", "*abstract_length*" et "*text_length*" qui donnent le nombre de mots dans les colonnes "*title*", "*abstract*" et "*text*" du dataframe "*df_corpus*". Pour le reste du TP, nous définirons la longueur du "*title*", "*abstract*" et du "*text*" comme étant le nombre de mots dans les chaînes de caractères respectives. Encore une fois, vous pouvez considérer que des mots sont simplement une séquence de caractères séparés par un espace.

```python
[14]: # Ajout de la colonne title_length qui compte le nombre de mots dans la colonne
      ↪title
      df_corpus["title_length"] = df_corpus["title"].apply(count_words)

      # Ajout de la colonne abstract_length qui compte le nombre de mots dans la
      ↪colonne abstract
      df_corpus["abstract_length"] = df_corpus["abstract"].apply(count_words)

      # Ajout de la colonne text_length qui compte le nombre de mots dans la colonne
      ↪text
      df_corpus["text_length"] = df_corpus["text"].apply(count_words)
```

```python
[15]: df_corpus
```

```
[15]:           doc_id                                              title  \
      0            4983  Microstructural development of human newborn c…
      1            5836  Induction of myelodysplasia by myeloid-derived…
      2            7912  BC1 RNA, the transcript from a master gene for…
      3           18670  The DNA Methylome of Human Peripheral Blood Mo…
      4           19238  The human myelin basic protein gene is include…
      …             …                                                  …
      5178    195689316  Body-mass index and cause-specific mortality i…
      5179    195689757  Targeting metabolic remodeling in glioblastoma…
      5180    196664003  Signaling architectures that transmit unidirec…
      5181    198133135  Association between pre-diabetes, type 2 diabe…
      5182    198309074  Adhesion molecules and chemokines: relation to…

                                             abstract  structured  \
      0     Alterations of the architecture of cerebral wh…       False
      1     Myelodysplastic syndromes (MDS) are age-depend…       False
      2     ID elements are short interspersed elements (S…       False
      3     DNA methylation plays an important role in bio…       False
      4     Two human Golli (for gene expressed in the oli…       False
      …                                              …            …
      5178  BACKGROUND The main associations of body-mass …        True
      5179  A key aberrant biological difference between t…       False
      5180  A signaling pathway transmits information from…       False
      5181  AIMS Trabecular bone score (TBS) is a surrogat…        True
```

```
5182  Introduction: Among the inflammatory mediators…         False

                                                    text  title_length  \
0     Microstructural development of human newborn c…           17
1     Induction of myelodysplasia by myeloid-derived…            7
2     BC1 RNA, the transcript from a master gene for…           20
3     The DNA Methylome of Human Peripheral Blood Mo…            9
4     The human myelin basic protein gene is include…           21
…                                                      …            …
5178  Body-mass index and cause-specific mortality i…           15
5179  Targeting metabolic remodeling in glioblastoma…            6
5180  Signaling architectures that transmit unidirec…            8
5181  Association between pre-diabetes, type 2 diabe…           14
5182  Adhesion molecules and chemokines: relation to…           13

      abstract_length  text_length
0                 278          295
1                 201          208
2                 180          200
3                 238          247
4                 241          262
…                   …            …
5178              413          428
5179              159          165
5180              246          254
5181              233          247
5182              233          246

[5183 rows x 8 columns]
```

**1.2.6 Analyse statistique (1.5 point)**   Faites l'analyse statistique des données en affichant le "*min*", le "*max*" et la "*moyenne*" pour les deux colonnes "*claim_length*" et "*num_cited_doc*" que vous venez de créer.

```python
[16]:  # Analyse statistique sur les deux colonnes "claim_length" et "num_cited_doc"
       stats = df_claims[['claim_length', 'num_cited_doc']].agg(['min', 'max', 'mean'])

       print(stats)
```

```
        claim_length  num_cited_doc
min         3.000000        1.00000
max        39.000000        5.00000
mean       12.332509        1.13597
```

```python
[17]:  list_var = ["claim_length", "num_cited_doc"]

       for var in list_var:
```

```python
    minimum = df_claims[var].min()
    maximum = df_claims[var].max()
    moyenne = df_claims[var].mean()

    # Affichage des mesures de dispersion pour chaque variable
    print(f"Tendances centrales de {var}\n Min: {minimum}\n Max: {maximum}\n␣
 ↪Moyenne: {moyenne:.2f}\n")
```

```
Tendances centrales de claim_length
 Min: 3
 Max: 39
 Moyenne: 12.33

Tendances centrales de num_cited_doc
 Min: 1
 Max: 5
 Moyenne: 1.14
```

**1.2.7 Histogrammes (2 points)** En considérant le dataframe du corpus de résumés ("*df_corpus*"), affichez dans 3 histogrammes les distributions suivantes:

- Fréquence des titres ('*title*') en fonction de leur longueur
- Fréquence des résumés ('*abstract*') en fonction de leur longueur
- Fréquence des textes ('*text*') en fonction de leur longueur

Utilisez la valeur de 30 pour le paramètre "*bins*"

```python
[18]: # Extraction des colonnes à etudier
list_var_graph = ["title", "abstract", "text"]

# Construction des histogrames pour chaque colonne
plt.figure(figsize=(15, 5))

for i, var in enumerate(list_var_graph, 1):
    plt.subplot(1, 3, i)
    plt.hist(df_corpus[f"{var}_length"], bins=30, alpha=0.7)
    plt.title(f"Distribution des longueurs de {var}")
    plt.xlabel(f"Longueur du {var} (nombre de mots)")
    plt.ylabel("Fréquence")
```
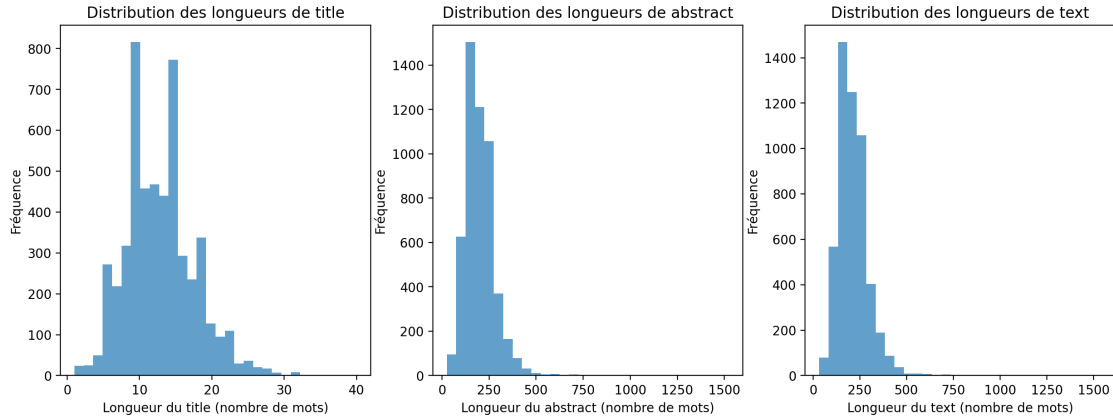
**1.2.8 Quelles remarques faites-vous sur les affirmations (claims) et les documents ? (1.5 points)**  En observant les maximums, les minimums et les moyennes, que remarquez-vous à propos des affirmations ('*claims*') ?  À l'aide des graphiques générés, comparez également les documents.

**En analysant les statistiques, nous observons les points suivants :**

- Certaines affirmations sont très courtes, tandis que d'autres sont relativement longues.
- En moyenne, une seule source est citée pour justifier une affirmation, ce qui semble limité.

En examinant les histogrammes, nous constatons que : - La colonne "title" n'apporte pas beaucoup d'informations supplémentaires par rapport à la colonne "text", car les distributions de "text" et "abstract" sont presque identiques.

**1.3 Pré-traitement (6 points)**  Les affirmations et résumés de texte de votre ensemble de données doivent d'abord être représentés et indexés pour ensuite pouvoir effectuer une recherche de document (pouvant être "*title*", "*abstract*" ou la fusion des deux représentée par "*text*") qui justifie/contredit une affirmation. Vous devez donc implémenter une étape de pré-traitement des données.

**1.3.1 Implémentation de la fonction "*tokenize_sentence*" (1 point)**  Implémentez la fonction "*tokenize_sentence*" pour la segmentation d'une phrase en une liste de jetons.  Utilisez la librarie `nltk`.

```
[19]: # Fonction de segmentation d'une phrase en liste de jetons
def tokenize_sentence(sentence):

    tokenized_sentence = word_tokenize(sentence)
    return tokenized_sentence
```

**1.3.2 Implémentation de la fonction "*tokenize_text*" (1 point)**  Implémentez la fonction "*tokenize_text*" qui utilise "*tokenize_sentence*" pour faire la segmentation d'un texte (liste de phrases).

12

```
[20]:  # Fonction utilisant "tokenize_sentence" pour segmenter un texte
       from nltk.tokenize import sent_tokenize


       def tokenize_text(text):

           sentences = sent_tokenize(text)
           tokenized_text = [tokenize_sentence(sentence) for sentence in sentences]
           return tokenized_text
```

**1.3.3 Implémentation de la fonction "*stem_tokens*" (1 point)**   Implémentez la fonction
"*stem_tokens*" qui prend une liste de jetons (tokens) en entrée et retourne une liste contenant leur
forme racinisée (stems) en utilisant l'algorithme de racinisation PorterStemmer de la bibliothèque
nltk.

```
[21]:  # Fonction de racinisation
       def stem_tokens(tokenized_text):

           stemmer = PorterStemmer()
           stemmed_tokens = [stemmer.stem(token) for token in tokenized_text]  #␣
         ↪Stemming des tokens
           return stemmed_tokens
```

**1.3.4 Pré-traitement (2 points)**   En utilisant vos précédentes fonctions, faites maintenant le
pré-traitement des champs "*text*", "*title*" et "*abstract*" du dataframe "*df_corpus*" et "*claim*" du
dataframe "*df_claims*" en suivant les étapes suivantes: - conversion en minuscules - segmentation
(tokenization) des passages - suppression des stop-words et ponctuation - racinisation (stemming)
des jetons

Nommez la liste des affirmations pré-traitées par "*claims_preprocessed*". Pour le corpus de doc-
uments considérez les ensembles de titres "*title*", de résumés "abstract" et la fusion des deux
"*text*" et nommez les listes correspondantes par "*titles_preprocessed*", "*abstracts_preprocessed*" et
"*texts_preprocessed*" respectivement.

```
[22]:  def preprocess_text(corpus):

           # Conversion en minuscules
           low_sentences = corpus.lower()

           # Tokenization des passages
           tokens = tokenize_text(low_sentences)

           # Suppression des stop-words et de la ponctuation
           clean_tokens = [
               token for sublist in tokens for token in sublist
               if token not in stop_words and token not in string.punctuation
           ]
           # Racinisation (stemming) des jetons
```

```
        stemmed_tokens = stem_tokens(clean_tokens)

        return stemmed_tokens
```

```
[23]:  # Application de la fonction à "claims" de df_claims
       df_claims['claims_preprocessed'] = df_claims["claim"].apply(preprocess_text)

       df_claims
```

```
[23]:        id                                                claim  \
       0       0  0-dimensional biomaterials lack inductive prop…
       1       2  1 in 5 million in UK have abnormal PrP positiv…
       2       4  1-1% of colorectal cancer patients are diagnos…
       3       6  10% of sudden infant death syndrome (SIDS) dea…
       4       9  32% of liver transplantation programs required…
       ..     …                                                  …
       804  1403  siRNA knockdown of A20 accelerates tumor progr…
       805  1404  siRNA knockdown of A20 slows tumor progression…
       806  1405  taa1 tar1 tar2 triple mutants in Arabidopsis d…
       807  1406   -sheet opening occurs during pleurotolysin po…
       808  1407                 1/Ketel is able to bind microtubules.

                                              evidence           cited_doc_ids  \
       0                                            {}              [31715818]
       1    {'13734012': [{'sentences': [4], 'label': 'CON…              [13734012]
       2                                            {}              [22942787]
       3                                            {}               [2613775]
       4    {'44265107': [{'sentences': [15], 'label': 'SU…              [44265107]
       ..                                             …                        …
       804  {'33370': [{'sentences': [6], 'label': 'CONTRA…       [33370, 38355793]
       805  {'33370': [{'sentences': [6], 'label': 'SUPPOR…       [33370, 38355793]
       806                                          {}              [10504681]
       807  {'2617858': [{'sentences': [4], 'label': 'SUPP…               [2617858]
       808                                          {}   [8087082, 29863668]

            claim_length  num_cited_doc  \
       0               5              1
       1              10              1
       2              12              1
       3              16              1
       4              13              1
       ..             …              …
       804            14              2
       805            14              2
       806            14              1
       807             7              1
       808             6              2
```

```
                               claims_preprocessed
0       [0-dimension, biomateri, lack, induct, properti]
1                   [1, 5, million, uk, abnorm, prp, posit]
2       [1-1, colorect, cancer, patient, diagnos, regi…
3       [10, sudden, infant, death, syndrom, sid, deat…
4       [32, liver, transplant, program, requir, patie…
..                                                    …
804     [sirna, knockdown, a20, acceler, tumor, progre…
805     [sirna, knockdown, a20, slow, tumor, progress,…
806     [taa1, tar1, tar2, tripl, mutant, arabidopsi, …
807     [ -sheet, open, occur, pleurotolysin, pore, fo…
808                      [ 1/ketel, abl, bind, microtubul]

[809 rows x 7 columns]
```

[24]: 
```python
# Application de la fonction à "title", "abstract" et "text" de df_corpus

df_corpus["titles_preprocessed"] = df_corpus["title"].apply(preprocess_text)
df_corpus["abstracts_preprocessed"] = df_corpus['abstract'].
 ↪apply(preprocess_text)
df_corpus["texts_preprocessed"] = df_corpus['text'].apply(preprocess_text)

df_corpus
```

[24]:
```
            doc_id                                          title  \
0             4983  Microstructural development of human newborn c…
1             5836  Induction of myelodysplasia by myeloid-derived…
2             7912  BC1 RNA, the transcript from a master gene for…
3            18670  The DNA Methylome of Human Peripheral Blood Mo…
4            19238  The human myelin basic protein gene is include…
…              …                                                …
5178     195689316  Body-mass index and cause-specific mortality i…
5179     195689757  Targeting metabolic remodeling in glioblastoma…
5180     196664003  Signaling architectures that transmit unidirec…
5181     198133135  Association between pre-diabetes, type 2 diabe…
5182     198309074  Adhesion molecules and chemokines: relation to…

                                      abstract  structured  \
0       Alterations of the architecture of cerebral wh…       False
1       Myelodysplastic syndromes (MDS) are age-depend…       False
2       ID elements are short interspersed elements (S…       False
3       DNA methylation plays an important role in bio…       False
4       Two human Golli (for gene expressed in the oli…       False
…                                             …               …
5178    BACKGROUND The main associations of body-mass …        True
5179    A key aberrant biological difference between t…       False
```

15

```
5180   A signaling pathway transmits information from…        False
5181   AIMS Trabecular bone score (TBS) is a surrogat…         True
5182   Introduction: Among the inflammatory mediators…        False

                                              text  title_length  \
0      Microstructural development of human newborn c…          17
1      Induction of myelodysplasia by myeloid-derived…           7
2      BC1 RNA, the transcript from a master gene for…          20
3      The DNA Methylome of Human Peripheral Blood Mo…           9
4      The human myelin basic protein gene is include…          21
…                                                  …           …
5178   Body-mass index and cause-specific mortality i…          15
5179   Targeting metabolic remodeling in glioblastoma…           6
5180   Signaling architectures that transmit unidirec…           8
5181   Association between pre-diabetes, type 2 diabe…          14
5182   Adhesion molecules and chemokines: relation to…          13

       abstract_length  text_length  \
0                  278          295
1                  201          208
2                  180          200
3                  238          247
4                  241          262
…                    …            …
5178               413          428
5179               159          165
5180               246          254
5181               233          247
5182               233          246

                              titles_preprocessed  \
0      [microstructur, develop, human, newborn, cereb…
1      [induct, myelodysplasia, myeloid-deriv, suppre…
2      [bc1, rna, transcript, master, gene, id, eleme…
3      [dna, methylom, human, peripher, blood, mononu…
4      [human, myelin, basic, protein, gene, includ, …
…                                                  …
5178   [body-mass, index, cause-specif, mortal, 900, …
5179   [target, metabol, remodel, glioblastoma, multi…
5180   [signal, architectur, transmit, unidirect, inf…
5181   [associ, pre-diabet, type, 2, diabet, trabecul…
5182   [adhes, molecul, chemokin, relat, anthropometr…

                           abstracts_preprocessed  \
0      [alter, architectur, cerebr, white, matter, de…
1      [myelodysplast, syndrom, md, age-depend, stem,…
2      [id, element, short, interspers, element, sine…
```

```
3       [dna, methyl, play, import, role, biolog, proc…
4       [two, human, golli, gene, express, oligodendro…
…                                                      …
5178    [background, main, associ, body-mass, index, b…
5179    [key, aberr, biolog, differ, tumor, cell, norm…
5180    [signal, pathway, transmit, inform, upstream, …
5181    [aim, trabecular, bone, score, tb, surrog, ind…
5182    [introduct, among, inflammatori, mediat, invol…

                                     texts_preprocessed
0       [microstructur, develop, human, newborn, cereb…
1       [induct, myelodysplasia, myeloid-deriv, suppre…
2       [bc1, rna, transcript, master, gene, id, eleme…
3       [dna, methylom, human, peripher, blood, mononu…
4       [human, myelin, basic, protein, gene, includ, …
…                                                      …
5178    [body-mass, index, cause-specif, mortal, 900, …
5179    [target, metabol, remodel, glioblastoma, multi…
5180    [signal, architectur, transmit, unidirect, inf…
5181    [associ, pre-diabet, type, 2, diabet, trabecul…
5182    [adhes, molecul, chemokin, relat, anthropometr…

[5183 rows x 11 columns]
```

**1.3.5 Jetons uniques (types) (1 point)**  Affichez maintenant le nombre total de jetons dans tous les textes (*text*) et affirmations (*claim*) (en les considérant comme un seul corpus) après le pré-traitement.  Puis, affichez le nombre de jetons uniques (types) dans les textes (*text*) et les affirmations (*claim*).

```python
[25]: # Combinaison des jetons pour les claims et les textes
      all_claims_tokens = [token for tokens in df_claims["claims_preprocessed"] for
       ↪token in tokens]
      all_texts_tokens = [token for tokens in df_corpus["texts_preprocessed"] for
       ↪token in tokens]

      # Calcul du nombre total des tokens dans les affirmations et textes
      all_tokens = all_claims_tokens + all_texts_tokens
      total_tokens = len(all_tokens)

      # Calcul du nombre de token unique dans les affirmation et textes
      all_unique_tokens = len(set(all_tokens))

      # Affichage

      print(f"Total tokens in corpus is: {total_tokens}")

      print("--------------------------------")
```

```
print(f"Unique tokens in corpus: {all_unique_tokens}")
```

```
Total tokens in corpus is: 742202
--------------------------------
Unique tokens in corpus: 45194
```

### 0.3.2  2. Représentation des affirmations et des documents (45 points)

**2.1 Vocabulaire (15 points)**

**2.1.1 Implémentation de la fonction "*get_vocab*" (3 points)**  Implémentez la fonction "*get_vocab*" qui prend une liste de textes composés chacun d'une liste de jetons et retourne un dictionnaire dont les clés sont les jetons uniques et les valeurs sont leur fréquence dans l'ensemble des textes.

```
[26]:  # Fonction retournant un dict de type {"jeton unique" : fréquence dans␣
       ↪l'ensemble des textes}
       def get_vocab(texts_list):

           all_tokens=[token for text in texts_list for token in text]
           vocab=dict(Counter(all_tokens))

           return vocab
```

**2.1.2 Implémentez la fonction "*show_top_N_types*" (3 points)**  Implémentez la fonction "show_top_N_types" qui affiche les N jetons les plus fréquents à partir d'un dictionnaire comme celui retourné par la fonction "*get_vocab*".

La fonction prend deux arguments: le dictionnaire "*dictionary*" et le paramètre "*N*".

```
[27]:  # Fonction qui affiche les N jetons les plus fréquents à partir d'un dict du␣
       ↪type de get_vocab
       def show_top_N_types(dictionary, N):

           # Tri du dictionnaire par les fréquences en ordre décroissant
           sorted_tokens=sorted(dictionary.items(),key=lambda item: item[1],␣
       ↪reverse=True)

           # Affichage des N jetons les plus fréquents
           print("Les", N, "types les plus fréquents:\n")
           for token, freq in sorted_tokens[:N]:
               print(f"('{token}', {freq})")
```

**2.1.3 Construction du vocabulaire (1 point)**  Construisez maintenant le vocabulaire pour les affirmations et le corpus de documents à partir des listes "texts_preprocessed" et "claims_preprocessed".

Ensuite affichez les 15 jetons les plus fréquents ainsi que leur fréquence.

```
[28]:  # Vocabulaire pour les textes
       vocab = get_vocab(pd.
        ↪concat([df_claims["claims_preprocessed"],df_corpus["texts_preprocessed"]]))

       # Affichage les 15 jetons les plus fréquents
       show_top_N_types(vocab, 15)
```

Les 15 types les plus fréquents:

```
('cell', 10464)
('patient', 4175)
('activ', 4145)
('studi', 4014)
('use', 3799)
('express', 3626)
('result', 3213)
('protein', 3083)
('gene', 3004)
('cancer', 2945)
('increas', 2794)
('associ', 2659)
('effect', 2567)
('function', 2515)
('human', 2464)
```

Sortie attendue:

"'Nombre de types composant le vocabulaire: 45195 Les 15 types les plus fréquents: ('cell', 10464) ('patient', 4175) ('activ', 4145) ('studi', 4014) ('use', 3799) ('express', 3626) ('result', 3213) ('protein', 3083) ('gene', 3004) ('cancer', 2945) ('increas', 2794) ('associ', 2659) ('effect', 2567) ('function', 2515) ('human', 2464)

**2.1.4 Implémentation de la fonction "*show_distribution*" (4 points)** Implémentez la fonction "**show_distribution**" qui permet de visualiser la distribution des fréquences des jetons à partir d'un dictionnaire comme celui retourné par la fonction "*get_vocab*", en utilisant un graphique où l'axe des abscisses représente le rang d'un type (après un tri par ordre de fréquence décroissante) et l'axe des ordonnées représente sa fréquence sur une échelle logarithmique.

Par exemple, le point (10000, 10) voudrait dire que le 10000ème mot le plus fréquent a une fréquence à peu prés egale à 10 dans le vocabulaire.

```
[29]:  def show_distribution(dictionary):

           # Tri des tokens par leur fréquence par ordre decroissant
           sorted_tokens = sorted(dictionary.items(), key=lambda item: item[1],
        ↪reverse=True)

           # Extraction des fréquences
           frequencies = [freq for _, freq in sorted_tokens]
```

```
    # Calcul du rang des tokens
    ranks = np.arange(1, len(frequencies) + 1)

    # Personnalisation du graphique
    plt.figure(figsize=(10, 6))
    plt.plot(ranks, frequencies, marker="o", linestyle="none")
    plt.yscale("log")
    plt.title("Distribution des fréquences des tokens")
    plt.xlabel("Rang des jetons (échelle logarithmique)")
    plt.ylabel("Fréquence des tokens (échelle logarithmique)")
    plt.grid(True, which="both", ls="--")

    plt.show()
```
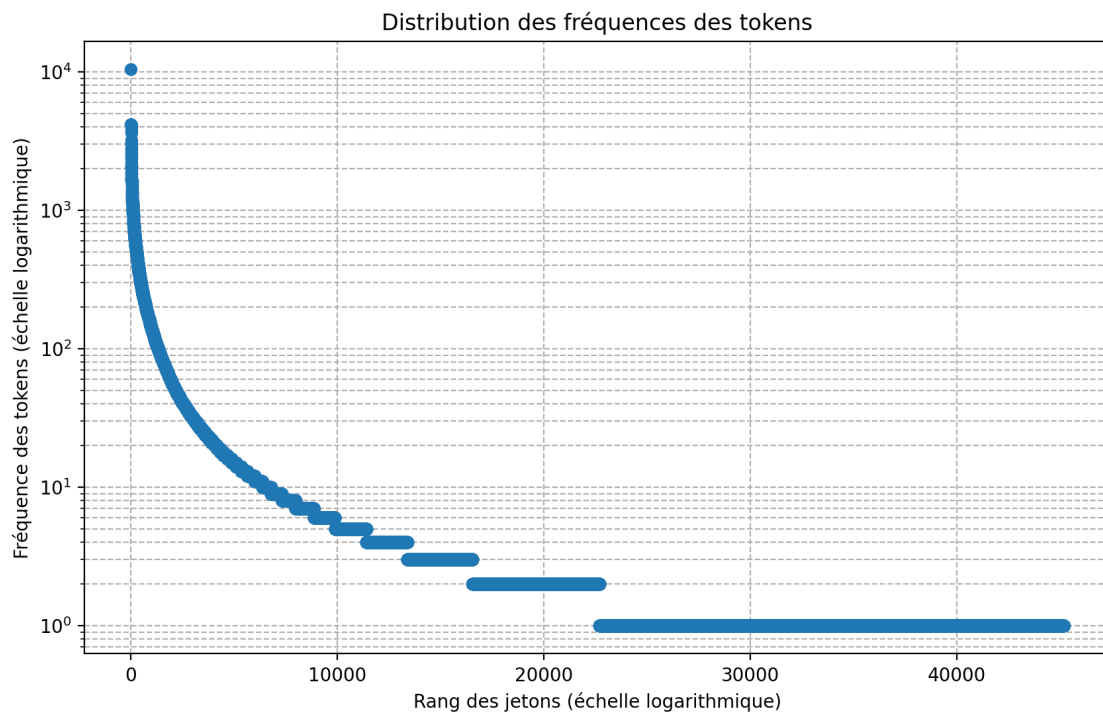
[30]:
```
# Application de la fonction à vocab

dist_result = show_distribution(vocab)
```



**2.1.5 Vérification de la loi de Zipf (4 points)**  Afin de vérifier la loi de Zipf, donnez une estimation de la valeur de la constante k de cette loi définie comme suit:

$$f \approx \frac{k}{r^\alpha}$$

où $f$ est la fréquence d'un mot, $r$ est le rang de ce mot dans la liste triée par fréquence décroissante, et $k$ est une constante. Etant données les fluctuations sur les valeurs de fréquence, vous pouvez utiliser la librairie 'powerlaw' conçue pour analyser et ajuster des distributions de loi de puissance aux données et qui peut être utile dans l'estimation de $ $.

Affichez la constante $k$ trouvée, les fréquences réelles des mots avec celles qui sont prédites par la loi de Zipf.

```python
# Tri des fréquences des mots par ordre décroissant
frequencies = sorted(vocab.values(), reverse=True)

# Estimation du paramètre alpha de la loi de puissance
data = powerlaw.Fit(frequencies)
alpha = data.power_law.alpha

# Tableau des rangs et ajustement avec alpha
r = np.arange(1, len(frequencies) + 1) ** (-alpha)

# Calcul de la pente k avec une régression linéaire
slope = np.polyfit(r, frequencies, 1)[0]
print(f"Constante k : {slope:.2f}")

# Fréquences prédites par la loi de Zipf
predicted_freq = [slope / ((i+1)**alpha) for i in range(len(frequencies))]

# Affichage du graphe
plt.figure(figsize=(10, 5))
plt.loglog(frequencies, label='Fréquences réelles', marker='.', linestyle='-')
plt.loglog(predicted_freq, label="Fréquences prédites par Zipf", marker="*",
    linestyle='-')
plt.xlabel("Rang des mots")
plt.ylabel('Fréquence')
plt.title('Comparaison des fréquences réelles et prédites par la loi de Zipf')
plt.legend()
plt.show()
```

Calculating best minimal value for power law fit
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progress: 70% xmin progress: 70% xmin progress: 71% xmin progress: 71% xmin
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progress: 80% xmin progress: 80% xmin progress: 80% xmin progress: 80% xmin
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progress: 85% xmin progress: 85% xmin progress: 86% xmin progress: 86% xmin
progress: 86% xmin progress: 86% xmin progress: 86% xmin progress: 86% xmin
progress: 86% xmin progress: 87% xmin progress: 87% xmin progress: 87% xmin
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progress: 95% xmin progress: 95% xmin progress: 95% xmin progress: 95% xmin
progress: 95% xmin progress: 95% xmin progress: 95% xmin progress: 96% xmin
```

```
progress: 96% xmin progress: 96% xmin progress: 96% xmin progress: 96% xmin
progress: 96% xmin progress: 97% xmin progress: 97% xmin progress: 97% xmin
progress: 97% xmin progress: 97% xmin progress: 97% xmin progress: 97% xmin
progress: 98% xmin progress: 98% xmin progress: 98% xmin progress: 98% xmin
progress: 98% xmin progress: 98% xmin progress: 99% xmin progress: 99% xmin
progress: 99% xmin progress: 99% xmin progress: 99% xmin progress: 99% Constante
k : 12131.76
```

Comparaison des fréquences réelles et prédites par la loi de Zipf
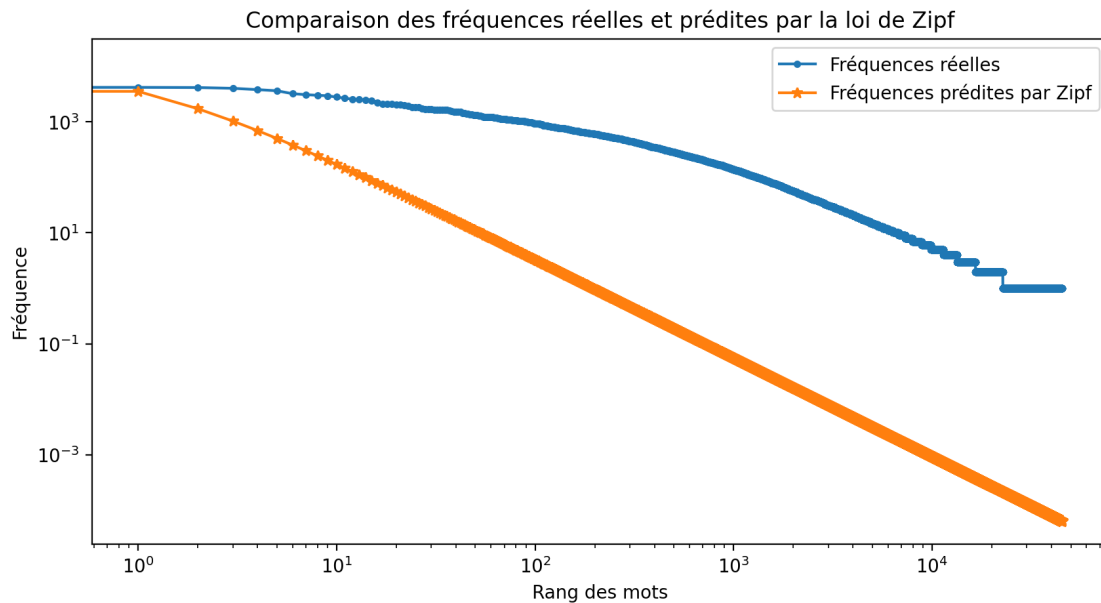


## 2.2 Création d'un modèle sac de mots (10 points)

**2.2.1 Réprésentation de texte (5 points)** En utilisant sklearn et à partir de vos
données pré-traitées (“*claims_preprocessed*”, “*titles_preprocessed*”, “*abstracts_preprocessed*” et
“*texts_preprocessed*”), représentez chaque affirmation (*claim*) et document avec le vocabulaire créé
’précédemment dans la variables “_claims_preprocessed_joined”, “*titles_preprocessed_joined*”,
“*abstract_preprocessed_joined*” et “*texts_preprocessed_joined*”. Cela veut dire que tout jeton qui
n'est pas dans le vocabulaire doit être enlevé dans le document et l'affirmation. Faites cela pour
les trois possibilités de représentation de document: “*title*”, “*abstract*” et “*text*”.

```python
[32]: def filter_join(tokens_listes, vocab):
          return [' '.join(token for token in tokens if token in vocab) for tokens in
      ↪tokens_listes]


      # Application du filtrage et de la jointure pour chaque colonne
      claims_preprocessed_joined = filter_join(df_claims['claims_preprocessed'],
      ↪vocab)
      titles_preprocessed_joined = filter_join(df_corpus['titles_preprocessed'],
      ↪vocab)
```

```
abstracts_preprocessed_joined =␣
 ↪filter_join(df_corpus['abstracts_preprocessed'], vocab)
texts_preprocessed_joined = filter_join(df_corpus['texts_preprocessed'], vocab)
```

[33]:
```python
# Fonction pour exclure les tokens qui ne sont pas dans le vocabulaire
def excluser_tokens(tokens, vocab):
    return [[token for token in tokens_list if token in vocab] for tokens_list␣
 ↪in tokens]

# Application de la fonction
claims_preprocessed_filtered =␣
 ↪excluser_tokens(df_claims['claims_preprocessed'], vocab)
titles_preprocessed_filtered =␣
 ↪excluser_tokens(df_corpus['titles_preprocessed'], vocab)
abstracts_preprocessed_filtered =␣
 ↪excluser_tokens(df_corpus['abstracts_preprocessed'], vocab)
texts_preprocessed_filtered = excluser_tokens(df_corpus['texts_preprocessed'],␣
 ↪vocab)

# Convertion des listes de tokens filtrés en chaînes de caractères avec la␣
 ↪fonction join()
claims_preprocessed_joined = [' '.join(tokens) for tokens in␣
 ↪claims_preprocessed_filtered]  # Liste d'affirmations prétraitées
titles_preprocessed_joined = [' '.join(tokens) for tokens in␣
 ↪titles_preprocessed_filtered]  # Liste de titres prétraités
abstracts_preprocessed_joined = [' '.join(tokens) for tokens in␣
 ↪abstracts_preprocessed_filtered]  # Liste d'abstracts prétraités
texts_preprocessed_joined = [' '.join(tokens) for tokens in␣
 ↪texts_preprocessed_filtered]  # Liste de textes prétraités
```

**2.2.2 Pondération (4 points)**   En utilisant un modèle sac de mots basé sur des unigrammes et des bigrammes, créez une représentation vectorielle de vos documents (titles, abstracts, texts) et de vos affirmations (claims) avec TF-IDF en utilisant le TfidfVectorizer de sklearn.

[34]:
```python
# Combiner les corpus
combined_corpus = claims_preprocessed_joined + texts_preprocessed_joined

# Initialiser et entraîner le TfidfVectorizer
tfidf_vectorizer = TfidfVectorizer(ngram_range=(1, 2))
tfidf_vectorizer.fit(combined_corpus)

# Application du TfidfVectorizer pour obtenir les représentations vectorielles␣
 ↪TF-IDF
claims_tfidf = tfidf_vectorizer.transform(claims_preprocessed_joined)
titles_tfidf = tfidf_vectorizer.transform(titles_preprocessed_joined)
abstracts_tfidf = tfidf_vectorizer.transform(abstracts_preprocessed_joined)
```

```
texts_tfidf = tfidf_vectorizer.transform(texts_preprocessed_joined) #
```

**2.2.3 Affichage (1 point)** Affichez les dimensions (shape) de vos corpus (claims, text, title, abstract) après vectorisation

[35]:
```
print("Claims TF-IDF shape:", claims_tfidf.shape)
```

Claims TF-IDF shape: (809, 473643)

Sortie attendue pour "*claims*"

(809, 473643)

[36]:
```
print("Texts TF-IDF shape:", texts_tfidf.shape)
```

Texts TF-IDF shape: (5183, 473643)

Sortie attendue pour "*texts*"

(5183, 473643)

[37]:
```
print("Titles TF-IDF shape:", titles_tfidf.shape)
```

Titles TF-IDF shape: (5183, 473643)

Sortie attendue pour "*titles*"

(5183, 473643)

[38]:
```
print("Abstracts TF-IDF shape:", abstracts_tfidf.shape)
```

Abstracts TF-IDF shape: (5183, 473643)

Sortie attendue pour abstracts "' (5183, 473643)

**2.3 Pertinence d'un document (20 points)** Maintenant que vous avez une représentation de vos affirmations "*claims*" et documents ("*texts*", "*titles*", "*abstracts*"), il faut être capable de déterminer quel document sera le plus pertinent pour une affirmation donnée.

**2.3.1 Implémentation de "*eval_similarity*" (3 points)** Implémentez la fonction "*eval_similarity*" pour évaluer la similarité cosinus entre la représentation de l'affirmation et celle de chaque document. La fonction prend une liste d'affirmations et une liste de documents et retourne une matrice où chaque ligne représente une affirmation et chaque colonne représente un document ("title", "abstract" ou "text") et les valeurs sont les similarités cosinus entre une affirmation et un document.

[39]:
```
# Fonction pour évaluer la similarité cosinus entre la représentation de
 ↪l'affirmation et celle de chaque document
def eval_similarity(claims_tfidf, documents_tfidf):

    similarity_matrix=cosine_similarity(claims_tfidf, documents_tfidf)
    return similarity_matrix
```

**2.3.2 Implémentation de la fonction "*rank_texts*" (2 points)**   Implémentez la fonction "*rank_texts*", qui, au moyen de la précédente (*eval_similarity*), retourne le top-N (N=1,3,5) des documents pertinents pour une affirmation donnée (N est un paramètre). Ces documents devront être ordonnés du plus pertinent au moins pertinent. Idéalement, le document à la position 1 sera celui qui contient la preuve (ou justification) de l'affirmation. Il faudra retourner non pas les indices des documents dans le dataframe mais plutôt leur identifiants au niveau de la colonne "*doc_id*".

```python
[40]: def rank_texts(claims_tfidf, docs_tfidf, N=5):

          # Calcul de la matrice de similarité cosinus entre les affirmations et les␣
       ↪documents
          similarity_matrix_claims_docs = cosine_similarity(claims_tfidf, docs_tfidf)

          # Initialisation de la liste des top N documents
          top_documents = []

          # Parcours de chaque affirmation
          for idx, similarities in enumerate(similarity_matrix_claims_docs):

              # Récupération des indices des N documents les plus similaires
              top_indices = np.argsort(similarities)[::-1][:N]

              # Récupération des identifiants des documents correspondants aux indices
              top_doc_ids = [str(df_corpus.iloc[i]['doc_id']) for i in top_indices]

              # Ajout à la liste finale des documents
              top_documents.append(top_doc_ids)

          return top_documents
```

```python
[41]: def rank_texts(claims_tfidf, docs_tfidf, N=5):

          # Calcul de la matrice de similarité cosinus entre les affirmations et les␣
       ↪documents
          similarity_matrix_claims_docs = cosine_similarity(claims_tfidf, docs_tfidf)

          top_documents = []   # Initialisation de la liste des top N documents

          # Pour chaque ligne dans la matrice de similarité (chaque affirmation)
          for idx, similarities in enumerate(similarity_matrix_claims_docs):
              # Récupération des indices des N documents les plus similaires
              top_indices = np.argsort(similarities)[::-1][:N]   # La méthode np.
       ↪argsort() permet de trier les indices
              # Récupération des identifiants des documents correspondants aux indices
              top_doc_ids = [str(df_corpus.iloc[i]['doc_id']) for i in top_indices] ␣
       ↪# Assurez-vous que les identifiants soient des chaînes
              # Ajout à la liste finale des documents
```

```
        top_documents.append(top_doc_ids)

    return top_documents
```

**2.3.3 Préparation des dataframes de réponses (1 point)**    Vous allez écrire la fonction "pre-pare_results_df" qui crée les dataframes qui vont contenir les résultats de la recherche de documents pertinents pour les affirmations.

La fonction "prepare_results_df" prend les arguments suivants:

- '*df*': le dataframe original nommé '*df_claims*' à partir duquel on crée les autres,
- '*columns_to_drop*': les colonnes à supprimer
- '*column_to_rename*': le nom de la colonne de référence dans le dataframe original qui sera renommée "gold standard passage"

et effectue les opérations suivantes:

1. Créer un nouveau dataframe à partir de "*df_claims*" en supprimant toutes les colonnes sauf "cited_doc_ids".
2. Renommer la colonne "cited_doc_ids" en "gold standard passage".
3. Ajouter les colonnes "top_1", "top_3", et "top_5" au dataframe, en les initialisant avec des chaînes de zéros séparés par des points- virgules, correspondant respectivement à des configurations de 1, 3, et 5 zéros pour toutes les lignes.

Vous utiliserez ensuite cette fonction pour créer les dataframes "results_titles_df", "re-sults_abstracts_df" et "results_texts_df", qui seront destinés à contenir les résultats de recherche de documents pour "title", "abstract" et "text" respectivement.

```python
[42]: def prepare_results_df(df, columns_to_drop, column_to_rename):

          # Création d'un nouveau df en supprimant les colonnes indiquées
          new_df = df.drop(columns=columns_to_drop)

          # Rename de la colonne spécifiée
          new_df = new_df.rename(columns={column_to_rename: "gold standard passage"})

          # Ajout des colonnes 'top_1', 'top_3', et 'top_5' initialisées avec des
      ↪chaînes de zéros
          new_df["top_1"] = "0"
          new_df["top_3"] = ";".join(["0"] * 3)
          new_df["top_5"] = ";".join(["0"] * 5)

          return new_df

      # Test de la fonction
      df = df_claims.copy()
      results_titles_df = prepare_results_df(df, ['claim', 'evidence',
      ↪'claim_length', 'num_cited_doc', 'claims_preprocessed'], 'cited_doc_ids')
```

```
print("Test de sortie sur le df_claims:")
results_titles_df.head(3)
```

Test de sortie sur le df_claims:

[42]:     id gold standard passage top_1  top_3       top_5
      0   0           [31715818]      0  0;0;0  0;0;0;0;0
      1   2           [13734012]      0  0;0;0  0;0;0;0;0
      2   4           [22942787]      0  0;0;0  0;0;0;0;0

Sortie attendue pour chaque dataframe préparé

.dataframe tbody tr th:only-of-type { vertical-align: middle; }

```
.dataframe tbody tr th {
    vertical-align: top;
}
```

```
.dataframe thead th {
    text-align: right;
}
```

id

gold standard passage

top_1

top_3

top_5

0

0

[31715818]

0

0;0;0

0;0;0;0;0

1

2

[13734012]

0

0;0;0

0;0;0;0;0

2

4

[22942787]

0

0;0;0

0;0;0;0;0

**2.3.4 Implémentation de la fonction "*fill_results*" (2 points)**   Vous devez maintenant implémenter la fonction "*fill_results*" qui remplit les dataframes préparés dans l'étape précédente en utilisant les resultats de recherche de document. Cette fonction prend les arguments suivant: - "*results*" : matrice contenant les valeurs de similarite des affirmations et des documents - "*results_texts_df*" : Dataframe contenant les affirmations ainsi que les colonnes "top_1", "top_3", "top_5" où doivent être mis les top-n documents les plus pertinents.

Les deux arguments contiennent le même nombre d'éléments et pour le même indice, font référence à la même affirmation.

```python
[43]: def fill_results(results, results_texts_df):

          # Parcourir chaque ligne de résultat (chaque affirmation)
          for i, top_n_doc_ids in enumerate(results):

              # Conversion des identifiants de document en chaînes de caractères
              top_n_doc_ids_str = [str(doc_id) for doc_id in top_n_doc_ids]

              # Remplissage des colonnes 'top_1', 'top_3', et 'top_5' pour chaque
          ↪affirmation
              results_texts_df.at[i, "top_1"] = top_n_doc_ids_str[0]   # Premier
          ↪document le plus pertinent
              results_texts_df.at[i, "top_3"] = ";".join(top_n_doc_ids_str[:3])   #
          ↪Les trois premiers documents
              results_texts_df.at[i, "top_5"] = ";".join(top_n_doc_ids_str[:5])   #
          ↪Les cinq premiers documents

          return results_texts_df
```

**2.3.5 Exécution des fonctions "*rank_texts*" et fill_results(2 points)**   Exécutez maintenant votre fonction "*rank_texts*" sur toutes les affirmations (claims) et toutes les représentations de documents (title, abstract, text) en mettant les résultats dans les variables "results_texts", "results_titles" et "results_abstracts". Ensuite appelez la fonction "*fill_results*" qui remplit les dataframes "*results_titles_df*", "*results_abstracts_df*", et "*results_texts_df*" contenant les résultats de recheche de documents.

```python
[44]: # Préparation des DataFrames résultats avec appel de la fonction
      ↪prepare_results_df
      results_titles_df = prepare_results_df(df_claims, ['claim', 'evidence',
      ↪'claim_length', 'num_cited_doc', 'claims_preprocessed'], 'cited_doc_ids')
```

```
results_abstracts_df = prepare_results_df(df_claims, ['claim', 'evidence',␣
 ↪'claim_length', 'num_cited_doc', 'claims_preprocessed'], 'cited_doc_ids')
results_texts_df = prepare_results_df(df_claims, ['claim', 'evidence',␣
 ↪'claim_length', 'num_cited_doc', 'claims_preprocessed'], 'cited_doc_ids')

# Appel de la fonction rank_texts
results_texts = rank_texts(claims_tfidf, texts_tfidf)
results_titles = rank_texts(claims_tfidf, titles_tfidf)
results_abstracts = rank_texts(claims_tfidf, abstracts_tfidf)
```

[45]: 
```
print("Appel de la fonction fill_results sur results_texts et results_texts_df")
fill_results(results_texts, results_texts_df)
```

Appel de la fonction fill_results sur results_texts et results_texts_df

[45]:
```
       id gold standard passage      top_1                          top_3  \
0       0            [31715818]   10608397   10608397;42421723;10607877
1       2            [13734012]   13734012   13734012;17333231;13770184
2       4            [22942787]    7165938        7165938;1387104;520579
3       6             [2613775]   23117378    23117378;2613775;21050357
4       9            [44265107]   44265107   44265107;24700152;14647747
..     …                     …          …                            …
804  1403     [33370, 38355793]      33370     33370;38355793;45764440
805  1404     [33370, 38355793]   38355793     38355793;33370;45764440
806  1405            [10504681]   20402596  20402596;10504681;38675228
807  1406             [2617858]    2617858      2617858;4465762;4857085
808  1407   [8087082, 29863668]    3801693     3801693;16090672;4820792

                                              top_5
0       10608397;42421723;10607877;21257564;35008773
1         13734012;17333231;13770184;42240424;3716075
2           7165938;1387104;520579;10958594;52188256
3        23117378;2613775;21050357;20240998;35521287
4       44265107;24700152;14647747;26105746;25182647
..                                                 …
804         33370;38355793;45764440;40412980;7986878
805         38355793;33370;45764440;40412980;7986878
806    20402596;10504681;38675228;5849439;14926162
807       2617858;4465762;4857085;10577574;13963620
808       3801693;16090672;4820792;30224907;7549811

[809 rows x 5 columns]
```

[46]: 
```
print("Appel de la fonction fill_results sur results_titles et␣
 ↪results_titles_df")
fill_results(results_titles, results_titles_df)
```

Appel de la fonction fill_results sur results_titles et results_titles_df

```
[46]:        id gold standard passage       top_1                            top_3  \
        0     0             [31715818]    10029970     10029970;42421723;4459491
        1     2             [13734012]     4828631        4828631;32481310;103007
        2     4             [22942787]    10958594    10958594;12074066;24980622
        3     6              [2613775]     2613775     2613775;23117378;21050357
        4     9             [44265107]    44265107    44265107;24700152;14647747
        ..   …                     …           …                            …
        804  1403    [33370, 38355793]     6944800        6944800;33370;24282306
        805  1404    [33370, 38355793]    32852283       32852283;6944800;33370
        806  1405             [10504681]   10504681    10504681;5849439;26378103
        807  1406              [2617858]    2617858     2617858;4857085;11419230
        808  1407    [8087082, 29863668]  45199834    45199834;16090672;30379039


                                                 top_5
        0       10029970;42421723;4459491;25950264;31543713
        1            4828631;32481310;103007;17415081;7020505
        2       10958594;12074066;24980622;39903312;42731834
        3        2613775;23117378;21050357;20287253;39381118
        4       44265107;24700152;14647747;26105746;29366489
        ..                                                …
        804        6944800;33370;24282306;13329980;38355793
        805        32852283;6944800;33370;24282306;13329980
        806        10504681;5849439;26378103;435529;7681810
        807       2617858;4857085;11419230;27768226;13283919
        808       45199834;16090672;30379039;4820792;38127792


        [809 rows x 5 columns]
```

```python
[47]: print("Appel de la fonction fill_results sur results_abstracts et␣
      ↪results_abstracts_df")
      fill_results(results_abstracts, results_abstracts_df)
```

    Appel de la fonction fill_results sur results_abstracts et results_abstracts_df

```
[47]:        id gold standard passage       top_1                             top_3  \
        0     0             [31715818]    10608397    10608397;10607877;21257564
        1     2             [13734012]    13734012    13734012;17333231;13770184
        2     4             [22942787]     7165938       7165938;1387104;52188256
        3     6              [2613775]    23117378     23117378;21050357;2613775
        4     9             [44265107]    44265107    44265107;24700152;14647747
        ..   …                     …           …                             …
        804  1403    [33370, 38355793]      33370        33370;38355793;7986878
        805  1404    [33370, 38355793]    38355793       38355793;33370;7986878
        806  1405             [10504681]   20402596    20402596;38675228;10504681
        807  1406              [2617858]    2617858       2617858;4465762;4857085
        808  1407    [8087082, 29863668]   3801693       3801693;16090672;4820792


                                                 top_5
```

```
0        10608397;10607877;21257564;994800;14827874
1        13734012;17333231;13770184;42240424;3716075
2         7165938;1387104;52188256;520579;43334921
3        23117378;21050357;2613775;20240998;35521287
4       44265107;24700152;14647747;25182647;32787042
..                                              …
804        33370;38355793;7986878;40412980;45764440
805        38355793;33370;7986878;40412980;45764440
806    20402596;38675228;10504681;5849439;19950357
807       2617858;4465762;4857085;13963620;10577574
808       3801693;16090672;4820792;30224907;7549811

[809 rows x 5 columns]
```

**2.3.6 Enregistrement des dataframes**  On enregistre les dataframes dans des fichiers .csv.

```
[48]: results_texts_df.to_csv('results_texts.csv',index=False, sep='\t')
      results_titles_df.to_csv('results_titles_df.csv',index=False, sep='\t')
      results_abstracts_df.to_csv('results_abstracts_df.csv',index=False, sep='\t')
```

**2.3.7 Implémentation de la fonction "*show_top_n_passages*" (3 points)**  Vous devez maintenant implémenter une fonction "*show_top_n_passages*" qui affiche le top-n ainsi que le texte (document) attendu pour une affirmation donnée. Ici on considère que document est représenté par "*text*" donc la fusion du titre ("*title*") et du résumé ("*abstract*")

```
[49]: def show_top_n_passages(claim_id, N):

          # Verification de l'existence de l'ID de l'affirmation dans df_claims
          try:
              claim_index = df_claims.index[df_claims['id'] == claim_id][0]
          except IndexError:
              print(f"Aucun ID d'affirmation trouvé pour {claim_id}.")
              return

          top_n_doc_ids = results_texts_df.at[claim_index, f'top_{N}'].split(';')

          print(f"Affichage des top-{N} documents pour l'affirmation ID {claim_id} :")

          for rank, doc_id in enumerate(top_n_doc_ids, start=1):
              print(f" - Rang {rank}: Document ID {doc_id}")
```

**2.3.8 Affichage (1 point)**  Appliquez cette fonction sur l'affirmation ayant pour identifiant 211 et affichez le top-5 des documents les plus pertinents retrouvés.

```
[50]: show_top_n_passages(211, 5)
```

```
Affichage des top-5 documents pour l'affirmation ID 211 :
 - Rang 1: Document ID 14019636
```

```
- Rang 2: Document ID 44737533
- Rang 3: Document ID 6290112
- Rang 4: Document ID 20261352
- Rang 5: Document ID 5137019
```

**2.3.9 Évaluation (3 points)**   Vous devez maintenant implémenter la fonction "*evaluate*" qui, à partir des colonnes *Gold standard passage* et de vos top-N respectifs, calcule la précision top-N (N=1,3,5) sur l'ensemble de données en paramètre et l'affiche.

Cette précision connue sous le nom "precision at k (precision@k)" se calcule de la manière suivante:

$$\text{precision@k} = \frac{\text{nombre d'éléments corrects}}{\text{nombre total d'éléments k retrouvés}}$$

Veillez à ce que la fonction soit générique.

```python
[51]: def evaluate_precision(results_df, gold_col='gold standard passage',
      ↪top_n_cols=None):

          # Définition des noms de colonnes par défaut si non fournis
          if top_n_cols is None:
              top_n_cols = ['top_1', 'top_3', 'top_5']

          # Initialisation des compteurs de précision
          precision_counts = {'@1': 0, '@3': 0, '@5': 0}

          # Calcul du nombre total de lignes (affirmations) dans le dataframe
          total_count = len(results_df)

          # Parcours de chaque ligne du dataframe
          for _, row in results_df.iterrows():

              # Conversion de la colonne de référence en un ensemble pour une
      ↪comparaison rapide
              gold_passages = set(map(str, row[gold_col]))

              # Obtention des documents top-N sous forme d'ensembles
              top_1_docs = set(row[top_n_cols[0]].split(';'))
              top_3_docs = set(row[top_n_cols[1]].split(';'))
              top_5_docs = set(row[top_n_cols[2]].split(';'))

              # Comptage du nombre de correspondances entre les passages de référence
      ↪et les documents top-N
              precision_counts['@1'] += len(gold_passages.intersection(top_1_docs))
              precision_counts['@3'] += len(gold_passages.intersection(top_3_docs))
              precision_counts['@5'] += len(gold_passages.intersection(top_5_docs))

          # Calcul de la précision pour chaque top-N
```

```python
        precision_at_1 = precision_counts['@1'] / total_count
        precision_at_3 = precision_counts['@3'] / (3 * total_count)
        precision_at_5 = precision_counts['@5'] / (5 * total_count)

        # Affichage des résultats
        print(f"Précision @1: {precision_at_1:.4f}")
        print(f"Précision @3: {precision_at_3:.4f}")
        print(f"Précision @5: {precision_at_5:.4f}")


        return precision_at_1, precision_at_3, precision_at_5
```

**2.3.10 Affichage (1 point)**   Appliquez cette fonction pour calculer la précision des documents retrouvés en utilisant les titres ("*title*"), les résumés ("*abstract*") et la fusion des deux ("*text*").

```python
[52]:  # Calcul de la précision à partir des résultats des titres
       print("Précision pour les titles :")
       precision_titles = evaluate_precision(results_titles_df)

       # Calcul de la précision à partir des résultats des résumés
       print("\nPrécision pour les abstracts :")
       precision_abstracts = evaluate_precision(results_abstracts_df)

       # Calcul de la précision à partir des résultats des textes (fusion de titre et
        ↪résumé)
       print("\nPrécision pour les texts (title + abstract) :")
       precision_texts = evaluate_precision(results_texts_df)
```

```
Précision pour les titles :
Précision @1: 0.3226
Précision @3: 0.1636
Précision @5: 0.1117

Précision pour les abstracts :
Précision @1: 0.4660
Précision @3: 0.2167
Précision @5: 0.1439

Précision pour les texts (title + abstract) :
Précision @1: 0.4870
Précision @3: 0.2254
Précision @5: 0.1520
```

**2.3.11 Graphique (2 points)**   Tracez un graphique des valeurs de précisions des documents retrouvés ("**title**", "**abstract**", "**text**") pour différents N (1,3,5).

```python
[53]:  # Définition des types de documents et des valeurs de N
       document_types = ['titles', 'abstracts', 'texts']
```

```python
N_values = [1, 3, 5]

# Dictionnaire contenant les précisions pour chaque type de document
precisions = {
    'titles': precision_titles,
    'abstracts': precision_abstracts,
    'texts': precision_texts
}

# Création de la figure
fig, ax = plt.subplots(figsize=(10, 6))

# Tracé des courbes de précision pour chaque type de document
for doc_type in document_types:
    ax.plot(N_values, precisions[doc_type], marker='o', label=doc_type)

# Ajout des étiquettes et de la légende
ax.set_title('Précision des documents retrouvés pour différents N')
ax.set_xlabel('Top-N')
ax.set_ylabel('Précision')
ax.set_xticks(N_values)
ax.legend()
ax.grid(True)

# Affichage du graphique
plt.show()
```



Précision des documents retrouvés pour différents N
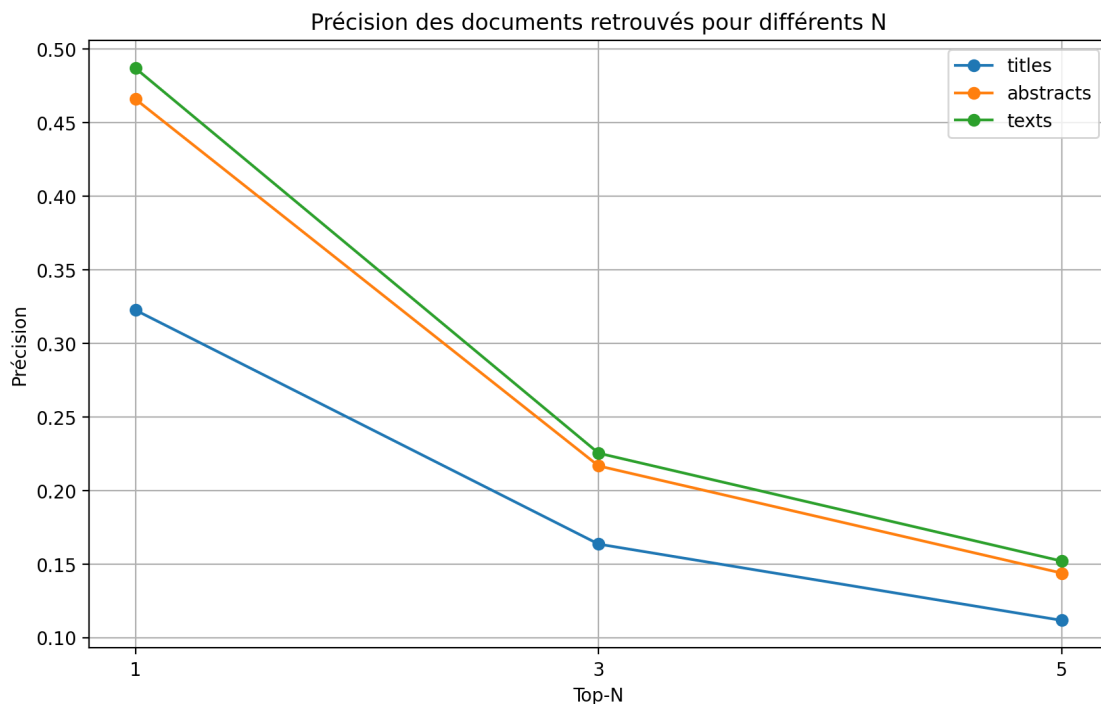
### 0.3.3 3 Amélioration avec BM25 (20 points)

BM25 (Best Matching 25) est un algorithme de recherche utilisé pour évaluer la pertinence des documents par rapport à une requête. Basé sur le modèle de récupération d'informations probabilistes, BM25 calcule un score de pertinence en tenant compte de la fréquence des termes de la requête dans chaque document et dans le corpus global mais aussi de la longueur des documents.

BM25 est pertinent pour la recherche d'information car il offre un bon équilibre entre précision et rappel, il gère efficacement de grandes collections de documents et permet des ajustements pour différents types de corpus. Il est largement utilisé dans les moteurs de recherche et les systèmes de recommandation.

Dans cette partie on vous demande de la tester au moyen de la librairie rank_bm25 pour cette tâche de recherche de texte qui justifie ou contredit une affirmation donnée. Vous allez utiliser le corpus et les affirmations et procéder comme indiqué dans la suite.

**3.1 Initialisation du modèle BM25 (3 points)** Réutilisez les variables "claims_preprocessed_joined", "texts_preprocessed_joined", "titles_preprocessed_joined" et "abstract_preprocessed_joined" définies à la question 2.2.1 pour initialiser les modèles BM25 pour les documents ("**titles**", "**abstracts**" et "**text**"). Il faudra transformer chaque séquence (dont les jetons étaient joints pour former une seule chaîne) en une liste de jetons. Vous utiliserez la classe "*BM25Okapi*" à ce niveau.

```
[54]: # Split des elements en liste de mots et stockage
      claims_preprocessed = [claim.split() for claim in claims_preprocessed_joined]
      titles_preprocessed = [title.split() for title in titles_preprocessed_joined]
      abstracts_preprocessed = [abstracts.split() for abstracts in↵
        ↪abstracts_preprocessed_joined]
      texts_preprocessed = [text.split() for text in texts_preprocessed_joined]

      # Initialisation des modèles BM25Okapi pour les titres, abstracts et textes.
      bm25_titles = BM25Okapi(titles_preprocessed)
      bm25_abstracts = BM25Okapi(abstracts_preprocessed)
      bm25_texts = BM25Okapi(texts_preprocessed)
```

**3.2 Utilisation du modèle BM25 (5 points)** Retrouvez les identifiants des documents pour les cinq meilleures correspondances de "*title*", de "*abstract*" et de "*text*" en utilisant le score BM25 pour chaque affirmation (claim) traitée, et mettez à jour les résultats avec les identifiants de documents correspondants.

```
[55]: # Initialisation des listes pour stocker les résultats des scores BM25
      results_titles_BM25 = []
      results_abstracts_BM25 = []
      results_texts_BM25 = []

      doc_ids = df_corpus['doc_id'].tolist()
```

```python
for claim in claims_preprocessed:

    # Calcul des scores BM25 pour titles, abstracts et texts
    title_scores = bm25_titles.get_scores(claim)
    abstract_scores = bm25_abstracts.get_scores(claim)
    text_scores = bm25_texts.get_scores(claim)

    # Sélection des indices des 5 meilleurs scores pour chaque catégorie
    top_titles = sorted(range(len(title_scores)), key=lambda k:␣
↪title_scores[k], reverse=True)[:5]
    top_abstracts = sorted(range(len(abstract_scores)), key=lambda k:␣
↪abstract_scores[k], reverse=True)[:5]
    top_texts = sorted(range(len(text_scores)), key=lambda k: text_scores[k],␣
↪reverse=True)[:5]

    # Ajout des IDs de documents correspondants aux listes de résultats
    results_titles_BM25.append([doc_ids[idx] for idx in top_titles])
    results_abstracts_BM25.append([doc_ids[idx] for idx in top_abstracts])
    results_texts_BM25.append([doc_ids[idx] for idx in top_texts])

# Affichage des résultats
print("Identifiants des documents pour les cinq meilleures correspondances pour␣
 ↪chaque affirmation :\n")
for index in range(len(results_titles_BM25)):
    titles = results_titles_BM25[index]
    abstracts = results_abstracts_BM25[index]
    texts = results_texts_BM25[index]
    print(f"Claim {index}:")
    print(f"  Titles    : {titles}")
    print(f"  Abstracts   : {abstracts}")
    print(f"  Texts    : {texts}\n")
```

Identifiants des documents pour les cinq meilleures correspondances pour chaque
affirmation :

Claim 0:
  Titles    : [16532419, 25602549, 42421723, 14831629, 34935825]
  Abstracts   : [26071782, 21257564, 825728, 28138927, 26731863]
  Texts    : [26071782, 21257564, 18953920, 26731863, 825728]

Claim 1:
  Titles    : [32481310, 4828631, 103007, 1583134, 3870062]
  Abstracts   : [13734012, 18617259, 42240424, 17333231, 21616324]
  Texts    : [13734012, 18617259, 4828631, 42240424, 17333231]

Claim 2:

```
Titles     : [24980622, 10958594, 39903312, 31616203, 12074066]
Abstracts  : [1387104, 24980622, 10958594, 5641851, 13030852]
Texts      : [10958594, 24980622, 1387104, 5641851, 13030852]

Claim 3:
  Titles     : [2613775, 23117378, 21050357, 7711685, 39381118]
  Abstracts  : [23117378, 2613775, 20240998, 35521287, 21050357]
  Texts      : [23117378, 2613775, 35521287, 20240998, 21050357]

Claim 4:
  Titles     : [44265107, 24700152, 9056874, 8190282, 14647747]
  Abstracts  : [44265107, 25182647, 24700152, 21186109, 16737210]
  Texts      : [44265107, 25182647, 24700152, 21186109, 14647747]

Claim 5:
  Titles     : [25510546, 8453819, 38477436, 29459383, 3943235]
  Abstracts  : [13780287, 4399311, 20904154, 32587939, 7482674]
  Texts      : [25510546, 29459383, 13780287, 4399311, 20904154]

Claim 6:
  Titles     : [25510546, 8453819, 38477436, 29459383, 19561411]
  Abstracts  : [13780287, 4399311, 20904154, 32587939, 7482674]
  Texts      : [25510546, 29459383, 13780287, 4399311, 20904154]

Claim 7:
  Titles     : [40971746, 43557480, 11822354, 23377475, 19804204]
  Abstracts  : [11705328, 33409100, 26025820, 43557480, 23377475]
  Texts      : [33409100, 11705328, 43557480, 26025820, 23377475]

Claim 8:
  Titles     : [393001, 3468459, 27647593, 8477699, 17195001]
  Abstracts  : [1373287, 6421792, 393001, 641786, 22712546]
  Texts      : [1373287, 6421792, 393001, 641786, 22712546]

Claim 9:
  Titles     : [27127885, 15337254, 39851630, 9997636, 2853291]
  Abstracts  : [25238950, 18953920, 3848469, 37912677, 3758260]
  Texts      : [25238950, 3848469, 18953920, 15337254, 3758260]

Claim 10:
  Titles     : [26611834, 34544514, 7662395, 5487448, 4810810]
  Abstracts  : [7662395, 17450673, 1263446, 25182647, 30786800]
  Texts      : [7662395, 1263446, 17450673, 25182647, 5487448]

Claim 11:
  Titles     : [24980622, 10958594, 39903312, 31616203, 12074066]
  Abstracts  : [1387104, 24980622, 10958594, 5641851, 13030852]
  Texts      : [10958594, 24980622, 1387104, 5641851, 13030852]
```

```
Claim 12:
  Titles    : [5002665, 36178047, 15907458, 7834603, 16284655]
  Abstracts  : [13072113, 7042304, 21232018, 3202143, 17209919]
  Texts    : [7042304, 13072113, 21232018, 16267205, 3202143]

Claim 13:
  Titles    : [5002665, 36178047, 15907458, 7834603, 16284655]
  Abstracts  : [13072113, 7042304, 3202143, 17209919, 21232018]
  Texts    : [7042304, 13072113, 21232018, 16267205, 3202143]

Claim 14:
  Titles    : [2488880, 19464037, 39300105, 16390264, 22414304]
  Abstracts  : [13843341, 45341480, 41493639, 23862975, 1259359]
  Texts    : [13843341, 45341480, 1259359, 41493639, 23862975]

Claim 15:
  Titles    : [21274919, 6490571, 31495049, 24318630, 83707680]
  Abstracts  : [6490571, 14682243, 73473433, 13934676, 21274919]
  Texts    : [6490571, 21274919, 14682243, 73473433, 13934676]

Claim 16:
  Titles    : [3471191, 10165723, 18488986, 1900152, 3545805]
  Abstracts  : [1900152, 15128866, 4468861, 3471191, 7975937]
  Texts    : [1900152, 15128866, 4468861, 3471191, 8963413]

Claim 17:
  Titles    : [2613775, 23117378, 21050357, 7711685, 39381118]
  Abstracts  : [23117378, 2613775, 20240998, 35521287, 21050357]
  Texts    : [23117378, 2613775, 35521287, 20240998, 21050357]

Claim 18:
  Titles    : [38410121, 739734, 37205685, 29460384, 19132741]
  Abstracts  : [79696454, 437924, 14260013, 1373287, 5492542]
  Texts    : [79696454, 437924, 14260013, 1373287, 38410121]

Claim 19:
  Titles    : [38410121, 37205685, 29460384, 19132741, 37207226]
  Abstracts  : [79696454, 437924, 14260013, 1373287, 5492542]
  Texts    : [79696454, 437924, 14260013, 1373287, 38410121]

Claim 20:
  Titles    : [12670680, 28149602, 14938990, 28015516, 8639034]
  Abstracts  : [12670680, 28015516, 28149602, 14938990, 5448119]
  Texts    : [12670680, 14938990, 28015516, 28149602, 5448119]

Claim 21:
  Titles    : [13069283, 24341590, 20454006, 2488880, 22482820]
```

```
  Abstracts   : [13069283, 24341590, 12438901, 20454006, 15721252]
  Texts     : [13069283, 24341590, 20454006, 12438901, 15721252]


Claim 22:
  Titles    : [33723822, 12428497, 2264455, 9161988, 6748318]
  Abstracts   : [12428497, 33723822, 27527854, 44629665, 2264455]
  Texts     : [12428497, 33723822, 27527854, 44629665, 2264455]


Claim 23:
  Titles    : [11705328, 10557471, 2481032, 8595678, 42441846]
  Abstracts   : [42441846, 11705328, 8595678, 37424881, 21636085]
  Texts     : [42441846, 11705328, 8595678, 37424881, 21636085]


Claim 24:
  Titles    : [16252863, 9555784, 11705328, 16256507, 13312471]
  Abstracts   : [42441846, 33409100, 18557974, 16252863, 37424881]
  Texts     : [42441846, 33409100, 18557974, 16252863, 37424881]


Claim 25:
  Titles    : [16252863, 9555784, 12810152, 11705328, 16256507]
  Abstracts   : [16252863, 33409100, 42441846, 12810152, 11705328]
  Texts     : [16252863, 33409100, 42441846, 12810152, 11705328]


Claim 26:
  Titles    : [13497630, 18344910, 9997636, 14682243, 17088791]
  Abstracts   : [13497630, 11109043, 34198460, 4423220, 15129362]
  Texts     : [13497630, 11109043, 9997636, 34198460, 17088791]


Claim 27:
  Titles    : [13497630, 18344910, 9997636, 25900857, 14682243]
  Abstracts   : [13497630, 11109043, 17088791, 34198460, 596817]
  Texts     : [13497630, 11109043, 9997636, 17088791, 34198460]


Claim 28:
  Titles    : [18174210, 40913091, 39571812, 45218443, 32181055]
  Abstracts   : [18174210, 40913091, 27162821, 4449524, 45218443]
  Texts     : [18174210, 40913091, 4449524, 27162821, 45218443]


Claim 29:
  Titles    : [19583924, 40234452, 11900630, 26474812, 18374364]
  Abstracts   : [5398179, 4816339, 8563659, 9433958, 35987381]
  Texts     : [5398179, 8563659, 4816339, 9433958, 40234452]


Claim 30:
  Titles    : [56893404, 16572581, 11880289, 2533768, 739734]
  Abstracts   : [56893404, 24704139, 2138843, 41264017, 3230557]
  Texts     : [56893404, 24704139, 2138843, 41264017, 3230557]
```

```
Claim 31:
  Titles    : [56893404, 16572581, 11880289, 2533768, 739734]
  Abstracts : [56893404, 41264017, 3230557, 24704139, 13282296]
  Texts     : [56893404, 41264017, 24704139, 3230557, 13282296]

Claim 32:
  Titles    : [380526, 20280410, 43334921, 2647374, 43329366]
  Abstracts : [380526, 43329366, 13519661, 17625068, 3868322]
  Texts     : [380526, 43329366, 13519661, 17625068, 3868322]

Claim 33:
  Titles    : [26996935, 6903077, 25811797, 23117928, 21230110]
  Abstracts : [26996935, 11336632, 3512154, 23117928, 28707489]
  Texts     : [26996935, 3512154, 11336632, 23117928, 28707489]

Claim 34:
  Titles    : [10024681, 15113221, 952111, 2140497, 654735]
  Abstracts : [45638119, 7821634, 25973484, 22401720, 5372432]
  Texts     : [45638119, 7821634, 10024681, 25973484, 22401720]

Claim 35:
  Titles    : [3973445, 24721866, 9899292, 22036571, 7005276]
  Abstracts : [49556906, 9899292, 3419709, 9752604, 19313533]
  Texts     : [9899292, 49556906, 1590744, 3419709, 9752604]

Claim 36:
  Titles    : [22185730, 13223806, 4709641, 33986200, 22116439]
  Abstracts : [4709641, 22116439, 4459491, 22185730, 11659421]
  Texts     : [4709641, 22116439, 4459491, 22185730, 11659421]

Claim 37:
  Titles    : [22227889, 12787125, 5735492, 26016929, 32481310]
  Abstracts : [39984099, 374902, 28806780, 13071728, 25134146]
  Texts     : [39984099, 374902, 28806780, 13071728, 25134146]

Claim 38:
  Titles    : [7547329, 22227889, 12787125, 5735492, 32481310]
  Abstracts : [39984099, 13899137, 374902, 46353045, 25134146]
  Texts     : [39984099, 13899137, 374902, 46353045, 25134146]

Claim 39:
  Titles    : [25510546, 8453819, 38477436, 29459383, 5687200]
  Abstracts : [25510546, 13780287, 4399311, 20904154, 32587939]
  Texts     : [25510546, 29459383, 13780287, 4399311, 20904154]

Claim 40:
  Titles    : [21295300, 13106686, 4391817, 10704438, 43880096]
  Abstracts : [12909503, 21295300, 5572127, 30122260, 16644043]
```

```
    Texts     : [12909503, 21295300, 30122260, 5572127, 16644043]


Claim 41:
  Titles    : [21295300, 13106686, 4391817, 10704438, 43880096]
  Abstracts : [12909503, 30122260, 21295300, 5572127, 16644043]
  Texts     : [12909503, 30122260, 21295300, 5572127, 16644043]


Claim 42:
  Titles    : [20399078, 17591478, 22482024, 40913091, 4449524]
  Abstracts : [39443128, 10326242, 25388309, 8925851, 6315132]
  Texts     : [39443128, 10326242, 20399078, 25388309, 8925851]


Claim 43:
  Titles    : [21295300, 10704438, 12909503, 43880096, 21219071]
  Abstracts : [21295300, 12909503, 213017, 5572127, 29422484]
  Texts     : [21295300, 12909503, 213017, 5572127, 29422484]


Claim 44:
  Titles    : [21295300, 21219071, 28697248, 7039855, 19079491]
  Abstracts : [21295300, 29422484, 21219071, 29429111, 28697248]
  Texts     : [21295300, 29422484, 21219071, 28697248, 29429111]


Claim 45:
  Titles    : [2582169, 11291348, 9169645, 39281166, 4414547]
  Abstracts : [5956380, 4414547, 21307488, 9669099, 23985464]
  Texts     : [5956380, 4414547, 21307488, 9669099, 23985464]


Claim 46:
  Titles    : [1127562, 5002665, 7036529, 7834603, 1576955]
  Abstracts : [1127562, 24864273, 16267205, 22362025, 18949516]
  Texts     : [1127562, 24864273, 16267205, 22362025, 7036529]


Claim 47:
  Titles    : [16737210, 41774099, 21859699, 45461275, 104130]
  Abstracts : [6076903, 17119869, 1031534, 15953181, 14492964]
  Texts     : [6076903, 17119869, 1031534, 15953181, 14333540]


Claim 48:
  Titles    : [14492339, 25657127, 4387784, 23342686, 22896970]
  Abstracts : [13965483, 2837758, 20330519, 26488879, 22703082]
  Texts     : [13965483, 2837758, 20330519, 26488879, 22703082]


Claim 49:
  Titles    : [5531479, 52925737, 43192375, 3330111, 9164724]
  Abstracts : [5531479, 52925737, 14407673, 45770026, 195683603]
  Texts     : [5531479, 52925737, 14407673, 195683603, 8774475]


Claim 50:
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  Titles     : [5531479, 52925737, 3330111, 9164724, 30675656]
  Abstracts  : [5531479, 52925737, 14407673, 45770026, 4350400]
  Texts      : [5531479, 52925737, 14407673, 45770026, 15248287]


Claim 51:
  Titles     : [5099266, 11661377, 154796494, 6082738, 8427306]
  Abstracts  : [5099266, 37608303, 8551160, 36066871, 29124963]
  Texts      : [5099266, 37608303, 8551160, 6082738, 10494012]


Claim 52:
  Titles     : [5099266, 4583180, 24005548, 6327940, 41781905]
  Abstracts  : [5099266, 4407455, 6000423, 34469966, 15414628]
  Texts      : [5099266, 4407455, 6000423, 34469966, 15414628]


Claim 53:
  Titles     : [4320424, 15365719, 24670522, 9160947, 13923140]
  Abstracts  : [7317051, 33507866, 24190159, 36310858, 41650417]
  Texts      : [4320424, 24190159, 7317051, 33507866, 36310858]


Claim 54:
  Titles     : [17119869, 2437807, 16964262, 23901235, 38919140]
  Abstracts  : [38919140, 16964262, 18038250, 15833835, 16939583]
  Texts      : [38919140, 16964262, 18038250, 33796570, 15833835]


Claim 55:
  Titles     : [3619372, 16375102, 4427392, 20033112, 39465575]
  Abstracts  : [21387297, 4427392, 20033112, 1905095, 3619372]
  Texts      : [21387297, 4427392, 3619372, 20033112, 1905095]


Claim 56:
  Titles     : [12827098, 12966719, 6722522, 3155731, 26611834]
  Abstracts  : [7521113, 4928057, 12827098, 2604063, 3155731]
  Texts      : [12827098, 7521113, 12966719, 4928057, 2604063]


Claim 57:
  Titles     : [12827098, 12966719, 6722522, 3155731, 26611834]
  Abstracts  : [7521113, 4928057, 12827098, 2604063, 3155731]
  Texts      : [12827098, 7521113, 12966719, 4928057, 2604063]


Claim 58:
  Titles     : [12827098, 12966719, 6446747, 19489351, 16999023]
  Abstracts  : [12827098, 3155731, 13116880, 10015292, 4928057]
  Texts      : [12827098, 3155731, 13116880, 10015292, 12966719]


Claim 59:
  Titles     : [25068298, 12827098, 24594624, 12966719, 24766509]
  Abstracts  : [4254064, 22973574, 24594624, 25068298, 25994317]
  Texts      : [4254064, 22973574, 24594624, 25068298, 25994317]
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Claim 60:
  Titles    : [25068298, 12827098, 24594624, 12966719, 24766509]
  Abstracts : [4254064, 22973574, 24594624, 25068298, 25994317]
  Texts     : [4254064, 22973574, 24594624, 25068298, 25994317]

Claim 61:
  Titles    : [13464392, 18988265, 33684572, 3230557, 22264117]
  Abstracts : [33733520, 45276789, 41493639, 16390264, 30553457]
  Texts     : [45276789, 33733520, 30553457, 41493639, 24906548]

Claim 62:
  Titles    : [13464392, 18988265, 33684572, 3230557, 22264117]
  Abstracts : [33733520, 41493639, 30553457, 5922085, 42950029]
  Texts     : [33733520, 30553457, 41493639, 42950029, 5922085]

Claim 63:
  Titles    : [4399311, 5386514, 32533299, 6000423, 15435343]
  Abstracts : [4399311, 34469966, 15435343, 6000423, 32533299]
  Texts     : [4399311, 15435343, 34469966, 32533299, 6000423]

Claim 64:
  Titles    : [4961038, 26121646, 7433668, 18025240, 13580614]
  Abstracts : [13966946, 25878014, 7433668, 23801039, 2042250]
  Texts     : [13966946, 7433668, 25878014, 23801039, 18025240]

Claim 65:
  Titles    : [14500725, 12258338, 6085365, 9274291, 24916604]
  Abstracts : [14500725, 6085365, 3662510, 9274291, 409280]
  Texts     : [14500725, 6085365, 3662510, 9274291, 409280]

Claim 66:
  Titles    : [4505748, 52175065, 6540064, 9846940, 2048139]
  Abstracts : [6540064, 37205759, 27264454, 18852643, 30351165]
  Texts     : [6540064, 37205759, 27264454, 18852643, 30351165]

Claim 67:
  Titles    : [52893592, 7227763, 32159283, 34054472, 17897801]
  Abstracts : [32159283, 24097933, 40164383, 14823313, 9306247]
  Texts     : [32159283, 24097933, 40164383, 17897801, 14823313]

Claim 68:
  Titles    : [164189, 2841164, 17097974, 11992632, 14591894]
  Abstracts : [36606083, 25787749, 15685921, 24307695, 164189]
  Texts     : [36606083, 25787749, 164189, 15685921, 24307695]

Claim 69:
  Titles    : [25515907, 45447613, 8318922, 30639847, 54490092]
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  Abstracts    : [25515907, 5151024, 54490092, 45447613, 44030361]
  Texts      : [25515907, 5151024, 45447613, 54490092, 8318922]


Claim 70:
  Titles     : [22995579, 30813140, 23865182, 24865781, 24770122]
  Abstracts    : [22995579, 23865182, 6191684, 24865781, 14606752]
  Texts      : [22995579, 23865182, 6191684, 24865781, 14606752]


Claim 71:
  Titles     : [29381091, 43192375, 1568684, 40232172, 32955023]
  Abstracts    : [4319174, 29381091, 14865329, 25687558, 970012]
  Texts      : [4319174, 29381091, 14865329, 970012, 32955023]


Claim 72:
  Titles     : [13513790, 7581911, 32776084, 2437807, 3360421]
  Abstracts    : [13513790, 23418635, 7581911, 4784069, 4416964]
  Texts      : [13513790, 7581911, 23418635, 13777138, 4784069]


Claim 73:
  Titles     : [6157837, 14584755, 356218, 140098548, 42865134]
  Abstracts    : [6157837, 1759213, 26199970, 25816994, 14584755]
  Texts      : [6157837, 1759213, 26199970, 25816994, 14584755]


Claim 74:
  Titles     : [56391045, 15194125, 20101846, 21789744, 33872649]
  Abstracts    : [33872649, 15194125, 2140513, 4942718, 21789744]
  Texts      : [33872649, 15194125, 2140513, 4942718, 21789744]


Claim 75:
  Titles     : [15879544, 33872649, 30226988, 18037805, 21232018]
  Abstracts    : [33872649, 2140513, 4942718, 3078080, 40005757]
  Texts      : [33872649, 2140513, 4942718, 3078080, 40005757]


Claim 76:
  Titles     : [18174210, 26132041, 13883546, 14606752, 8672737]
  Abstracts    : [14606752, 5691302, 22995579, 14566771, 15984735]
  Texts      : [14606752, 5691302, 14566771, 22995579, 17930286]


Claim 77:
  Titles     : [834336, 26132041, 13883546, 14606752, 9614443]
  Abstracts    : [14606752, 22995579, 5691302, 39390206, 14566771]
  Texts      : [14606752, 22995579, 5691302, 39390206, 14566771]


Claim 78:
  Titles     : [12801438, 31460499, 4695107, 4664540, 24157077]
  Abstracts    : [24157077, 1234098, 36497180, 20132778, 43165768]
  Texts      : [24157077, 12801438, 1234098, 36497180, 43165768]
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Claim 79:
  Titles     : [12801438, 31460499, 4695107, 4664540, 24157077]
  Abstracts  : [24157077, 1234098, 36497180, 20132778, 43165768]
  Texts      : [24157077, 12801438, 1234098, 36497180, 43165768]

Claim 80:
  Titles     : [7111021, 4883040, 3033830, 27768226, 19058822]
  Abstracts  : [4883040, 31363207, 7111021, 13899137, 17077004]
  Texts      : [4883040, 31363207, 13899137, 7111021, 17077004]

Claim 81:
  Titles     : [20996244, 23915841, 21323587, 24943534, 601033]
  Abstracts  : [27063470, 28738741, 5867846, 23985464, 46202852]
  Texts      : [28738741, 27063470, 5867846, 46202852, 23985464]

Claim 82:
  Titles     : [35087728, 2844897, 5824985, 27024392, 21884449]
  Abstracts  : [39059143, 21884449, 14395738, 5912283, 20188586]
  Texts      : [21884449, 39059143, 35087728, 14395738, 5824985]

Claim 83:
  Titles     : [26016929, 21636085, 21060008, 457630, 19521501]
  Abstracts  : [26016929, 21914176, 457630, 1358909, 10893238]
  Texts      : [26016929, 457630, 21914176, 1358909, 10893238]

Claim 84:
  Titles     : [4468861, 13889430, 1522647, 24159217, 5649538]
  Abstracts  : [6807122, 15678772, 49556906, 31293581, 37912677]
  Texts      : [6807122, 15678772, 31293581, 49556906, 3847200]

Claim 85:
  Titles     : [10582939, 2853291, 24766509, 25985964, 40164383]
  Abstracts  : [10582939, 7583161, 14192687, 40164383, 24766509]
  Texts      : [10582939, 40164383, 7583161, 14192687, 24766509]

Claim 86:
  Titles     : [6227220, 2481032, 1907601, 41120293, 5268462]
  Abstracts  : [6227220, 31001322, 10463997, 56528795, 39558597]
  Texts      : [6227220, 31001322, 56528795, 10463997, 39558597]

Claim 87:
  Titles     : [15488881, 12324049, 9705208, 7020505, 37269418]
  Abstracts  : [15488881, 1471041, 38587347, 15058155, 38899659]
  Texts      : [15488881, 38587347, 1471041, 15058155, 38899659]

Claim 88:
  Titles     : [9929089, 16494316, 4702639, 1917068, 34469966]
  Abstracts  : [2272614, 25895285, 9929089, 9505402, 711256]
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  Texts     : [2272614, 9929089, 25895285, 9505402, 711256]


Claim 89:
  Titles    : [9929089, 16494316, 4702639, 1917068, 34469966]
  Abstracts : [2272614, 25895285, 9929089, 9505402, 711256]
  Texts     : [2272614, 9929089, 25895285, 9505402, 711256]


Claim 90:
  Titles    : [34436231, 10450725, 18855191, 778436, 37549932]
  Abstracts : [37549932, 22890091, 4323425, 34436231, 10218447]
  Texts     : [37549932, 22890091, 34436231, 4323425, 10218447]


Claim 91:
  Titles    : [34436231, 10450725, 3730196, 37549932, 10670430]
  Abstracts : [37549932, 22890091, 4323425, 10218447, 34436231]
  Texts     : [37549932, 22890091, 34436231, 4323425, 10218447]


Claim 92:
  Titles    : [39637840, 2679511, 2758012, 17939443, 4411655]
  Abstracts : [13439128, 39637840, 2758012, 16217855, 2679511]
  Texts     : [13439128, 39637840, 2758012, 16217855, 2679511]


Claim 93:
  Titles    : [9394119, 4414547, 24144677, 9211173, 8892905]
  Abstracts : [2015126, 9394119, 3285322, 22975806, 4414547]
  Texts     : [2015126, 9394119, 3285322, 22975806, 4414547]


Claim 94:
  Titles    : [52874170, 23816832, 3078080, 654735, 27866735]
  Abstracts : [52874170, 23816832, 3078080, 5260382, 45449835]
  Texts     : [52874170, 23816832, 3078080, 5260382, 654735]


Claim 95:
  Titles    : [6903077, 7688110, 29288582, 19427410, 26751583]
  Abstracts : [6903077, 20187433, 28931537, 1398021, 13868795]
  Texts     : [6903077, 20187433, 28931537, 1398021, 13868795]


Claim 96:
  Titles    : [29022271, 43220289, 27768226, 40949706, 18872233]
  Abstracts : [5824985, 18872233, 7627167, 29022271, 43220289]
  Texts     : [5824985, 18872233, 29022271, 7627167, 43220289]


Claim 97:
  Titles    : [29022271, 43220289, 27768226, 38551172, 40949706]
  Abstracts : [5824985, 18872233, 15559582, 13831842, 7627167]
  Texts     : [5824985, 18872233, 15559582, 29022271, 7627167]


Claim 98:
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  Titles      : [18872233, 43220289, 19071857, 5824985, 29022271]
  Abstracts   : [18872233, 43220289, 29022271, 19071857, 5824985]
  Texts       : [18872233, 19071857, 43220289, 29022271, 5824985]


Claim 99:
  Titles      : [18872233, 43220289, 19071857, 5824985, 29022271]
  Abstracts   : [18872233, 43220289, 29022271, 19071857, 5824985]
  Texts       : [18872233, 19071857, 43220289, 29022271, 5824985]


Claim 100:
  Titles      : [7627167, 29022271, 43220289, 40949706, 18872233]
  Abstracts   : [5824985, 7627167, 29022271, 18872233, 43220289]
  Texts       : [5824985, 7627167, 29022271, 18872233, 43220289]


Claim 101:
  Titles      : [7627167, 29022271, 43220289, 38551172, 40949706]
  Abstracts   : [5824985, 7627167, 15559582, 13831842, 29022271]
  Texts       : [5824985, 7627167, 15559582, 13831842, 29022271]


Claim 102:
  Titles      : [12670680, 28149602, 14938990, 28015516, 5448119]
  Abstracts   : [12670680, 28015516, 28149602, 14938990, 5448119]
  Texts       : [12670680, 14938990, 28015516, 28149602, 5448119]


Claim 103:
  Titles      : [20725212, 29877890, 13907427, 8411251, 30184745]
  Abstracts   : [8411251, 20781656, 13907427, 29877890, 20524091]
  Texts       : [8411251, 20781656, 29877890, 13907427, 20524091]


Claim 104:
  Titles      : [6985854, 5377059, 25597580, 79336156, 54561709]
  Abstracts   : [2947540, 4340358, 6985854, 79336156, 25597580]
  Texts       : [2947540, 6985854, 79336156, 25597580, 4340358]


Claim 105:
  Titles      : [6985854, 5377059, 25597580, 79336156, 54561709]
  Abstracts   : [79336156, 2947540, 4340358, 6985854, 10624000]
  Texts       : [79336156, 2947540, 6985854, 25597580, 4340358]


Claim 106:
  Titles      : [25510546, 8453819, 38477436, 29459383, 5687200]
  Abstracts   : [25510546, 13780287, 4399311, 20904154, 32587939]
  Texts       : [25510546, 29459383, 13780287, 4399311, 20904154]


Claim 107:
  Titles      : [9669099, 21557055, 11903247, 14367469, 43880096]
  Abstracts   : [9669099, 21557055, 37204802, 43880096, 7225911]
  Texts       : [9669099, 21557055, 37204802, 43880096, 7225911]
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Claim 108:
  Titles    : [2140497, 4414547, 16086778, 16734530, 20280410]
  Abstracts : [13831558, 1171121, 3285322, 2140497, 4886637]
  Texts     : [13831558, 1171121, 3285322, 2140497, 12762485]

Claim 109:
  Titles    : [16966326, 35231675, 9217800, 13380011, 41644178]
  Abstracts : [16966326, 9217800, 13380011, 6722522, 2543135]
  Texts     : [16966326, 9217800, 13380011, 6722522, 2543135]

Claim 110:
  Titles    : [6374918, 13205096, 4387494, 11344428, 12903921]
  Abstracts : [19510470, 10795340, 8385277, 13205096, 37248765]
  Texts     : [19510470, 6374918, 10795340, 8385277, 13205096]

Claim 111:
  Titles    : [10078024, 12827098, 3758260, 35811036, 4380004]
  Abstracts : [8137081, 10078024, 12827098, 17271462, 1122198]
  Texts     : [12827098, 8137081, 17271462, 10078024, 46193388]

Claim 112:
  Titles    : [17374970, 41380943, 34228604, 44624045, 2295434]
  Abstracts : [17374970, 12789595, 84580585, 2867345, 24159217]
  Texts     : [17374970, 12789595, 84580585, 2867345, 24159217]

Claim 113:
  Titles    : [17374970, 41380943, 34228604, 44624045, 2295434]
  Abstracts : [17374970, 12789595, 84580585, 2867345, 24159217]
  Texts     : [17374970, 12789595, 84580585, 2867345, 24159217]

Claim 114:
  Titles    : [3566945, 4421578, 7177329, 13469921, 26038789]
  Abstracts : [5560962, 3566945, 4421578, 4373433, 23915841]
  Texts     : [3566945, 5560962, 4421578, 4373433, 7177329]

Claim 115:
  Titles    : [19313533, 5108807, 9752604, 9021186, 23052989]
  Abstracts : [19313533, 9899292, 26025820, 3419709, 3973445]
  Texts     : [19313533, 26025820, 3419709, 9899292, 3973445]

Claim 116:
  Titles    : [6123924, 4422734, 327319, 36889513, 26607366]
  Abstracts : [2177022, 40590358, 13778710, 25942757, 6123924]
  Texts     : [2177022, 40590358, 13778710, 6123924, 25942757]

Claim 117:
  Titles    : [46353045, 5839365, 22130056, 12705056, 22707413]
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  Abstracts   : [2177022, 13778710, 40590358, 23634484, 8494570]
  Texts     : [2177022, 13778710, 40590358, 23634484, 8494570]


Claim 118:
  Titles    : [18231807, 2462673, 40365566, 2014909, 13868795]
  Abstracts   : [18231807, 35651106, 13868795, 28006126, 40473317]
  Texts     : [18231807, 35651106, 13868795, 28006126, 2462673]


Claim 119:
  Titles    : [2462673, 17017465, 36398420, 35079452, 13868795]
  Abstracts   : [35651106, 2462673, 28006126, 13868795, 8038329]
  Texts     : [2462673, 35651106, 28006126, 13868795, 18231807]


Claim 120:
  Titles    : [9558539, 87430549, 25513319, 41548287, 24349992]
  Abstracts   : [9558539, 25513319, 15946643, 7583725, 9600826]
  Texts     : [9558539, 25513319, 41548287, 15946643, 7583725]


Claim 121:
  Titles    : [470625, 24921368, 3174305, 41380943, 2739854]
  Abstracts   : [7898952, 470625, 4412772, 25479072, 4414547]
  Texts     : [7898952, 470625, 4412772, 25479072, 4414547]


Claim 122:
  Titles    : [470625, 1840993, 1544804, 3174305, 41380943]
  Abstracts   : [470625, 7898952, 4412772, 4414547, 29125354]
  Texts     : [470625, 7898952, 4412772, 4414547, 29125354]


Claim 123:
  Titles    : [25510546, 8453819, 38477436, 29459383, 5687200]
  Abstracts   : [25510546, 13780287, 4399311, 35760786, 20904154]
  Texts     : [25510546, 29459383, 13780287, 4399311, 35760786]


Claim 124:
  Titles    : [13794374, 20288322, 33569870, 8816869, 11742219]
  Abstracts   : [13794374, 8458567, 21547032, 6903077, 14019636]
  Texts     : [13794374, 31154082, 8458567, 35760786, 21547032]


Claim 125:
  Titles    : [8300657, 13794374, 5633957, 7451018, 4993011]
  Abstracts   : [6903077, 25606339, 2758012, 6290112, 44737533]
  Texts     : [25606339, 6903077, 2758012, 6290112, 44737533]


Claim 126:
  Titles    : [27054878, 750781, 7640792, 25028913, 6121668]
  Abstracts   : [27054878, 9846940, 40156901, 20887554, 750781]
  Texts     : [27054878, 9846940, 40156901, 750781, 20887554]
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Claim 127:
  Titles    : [19205437, 15535511, 11742219, 25183830, 10846815]
  Abstracts : [19205437, 14865329, 1590744, 15535511, 17231273]
  Texts     : [19205437, 14865329, 15535511, 1590744, 11742219]

Claim 128:
  Titles    : [10846815, 37964706, 970012, 7438803, 52865789]
  Abstracts : [19205437, 29362104, 37964706, 5094468, 7869794]
  Texts     : [19205437, 29362104, 37964706, 17231273, 10562341]

Claim 129:
  Titles    : [10846815, 19205437, 37964706, 7438803, 52865789]
  Abstracts : [19205437, 29362104, 37964706, 5094468, 7869794]
  Texts     : [19205437, 29362104, 37964706, 17231273, 10562341]

Claim 130:
  Titles    : [5836, 15435343, 2014909, 25726838, 31564409]
  Abstracts : [42465769, 2014909, 5483793, 24612804, 28149602]
  Texts     : [2014909, 42465769, 5483793, 2030623, 25726838]

Claim 131:
  Titles    : [952111, 32742683, 3559136, 25726838, 9648896]
  Abstracts : [32742683, 10812605, 8702697, 35993767, 9648896]
  Texts     : [32742683, 10812605, 35993767, 952111, 9648896]

Claim 132:
  Titles    : [952111, 9648896, 32742683, 2130391, 3376731]
  Abstracts : [3727986, 32742683, 9648896, 10812605, 35993767]
  Texts     : [32742683, 3727986, 9648896, 10812605, 35993767]

Claim 133:
  Titles    : [952111, 9648896, 32742683, 2130391, 3376731]
  Abstracts : [3727986, 32742683, 9648896, 10812605, 35993767]
  Texts     : [3727986, 32742683, 9648896, 10812605, 35993767]

Claim 134:
  Titles    : [5406411, 40710501, 46127781, 9909405, 14555750]
  Abstracts : [26973393, 22980205, 22401720, 34066665, 9929089]
  Texts     : [26973393, 22980205, 5406411, 34066665, 6550579]

Claim 135:
  Titles    : [12827098, 4928057, 4460880, 2973910, 4932668]
  Abstracts : [4928057, 12827098, 7521113, 4460880, 3984231]
  Texts     : [4928057, 12827098, 7521113, 4460880, 12966719]

Claim 136:
  Titles    : [56893404, 8892905, 1866911, 17656445, 27449472]
  Abstracts : [56893404, 9394119, 8892905, 1387104, 3285322]
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  Texts      : [56893404, 9394119, 8892905, 1387104, 3285322]


Claim 137:
  Titles     : [4388470, 23581096, 37822406, 86129154, 5597586]
  Abstracts  : [4388470, 5597586, 36708463, 9047718, 7011850]
  Texts      : [4388470, 5597586, 36708463, 9047718, 7011850]


Claim 138:
  Titles     : [4385779, 8087082, 3805841, 10704438, 38127792]
  Abstracts  : [11557602, 4320111, 19979816, 14471161, 8816869]
  Texts      : [11557602, 4320111, 14471161, 19979816, 8816869]


Claim 139:
  Titles     : [4385779, 8087082, 3805841, 10704438, 38127792]
  Abstracts  : [11557602, 4320111, 19979816, 14471161, 8816869]
  Texts      : [11557602, 4320111, 14471161, 19979816, 8816869]


Claim 140:
  Titles     : [8148122, 36618603, 18489989, 23418635, 1447990]
  Abstracts  : [8148122, 24766509, 14225271, 3174305, 42106119]
  Texts      : [8148122, 24766509, 14225271, 22428640, 3874000]


Claim 141:
  Titles     : [21498497, 32927401, 24707550, 23273454, 31313782]
  Abstracts  : [21498497, 14644164, 8596357, 46135768, 5798227]
  Texts      : [21498497, 14644164, 24707550, 8596357, 5798227]


Claim 142:
  Titles     : [3430789, 22547508, 25104843, 24097933, 12209494]
  Abstracts  : [3430789, 25104843, 22547508, 19132741, 33203108]
  Texts      : [3430789, 25104843, 22547508, 19132741, 33203108]


Claim 143:
  Titles     : [22547508, 3430789, 25104843, 24097933, 12209494]
  Abstracts  : [3430789, 25104843, 22547508, 19132741, 33203108]
  Texts      : [3430789, 25104843, 22547508, 19132741, 24097933]


Claim 144:
  Titles     : [13578199, 18895793, 44387884, 5764562, 10669582]
  Abstracts  : [10474873, 10669582, 13578199, 26008462, 44420873]
  Texts      : [10474873, 13578199, 26008462, 10669582, 44420873]


Claim 145:
  Titles     : [1568684, 29381091, 40232172, 14865329, 18450716]
  Abstracts  : [1568684, 4319174, 52865789, 29381091, 29691654]
  Texts      : [1568684, 4319174, 52865789, 14865329, 29381091]


Claim 146:
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  Titles     : [1568684, 29381091, 40232172, 14865329, 18450716]
  Abstracts  : [1568684, 4319174, 29691654, 29381091, 14865329]
  Texts      : [1568684, 14865329, 4319174, 29381091, 29691654]


Claim 147:
  Titles     : [8595678, 19278208, 42441846, 14566771, 37424881]
  Abstracts  : [42441846, 8595678, 37424881, 12810152, 10557471]
  Texts      : [42441846, 8595678, 37424881, 12810152, 10557471]


Claim 148:
  Titles     : [8595678, 19278208, 42441846, 14566771, 37424881]
  Abstracts  : [42441846, 8595678, 37424881, 12810152, 10557471]
  Texts      : [42441846, 8595678, 37424881, 12810152, 10557471]


Claim 149:
  Titles     : [9142761, 44660616, 6876224, 75636923, 10976596]
  Abstracts  : [5850219, 3413083, 829646, 8298120, 75636923]
  Texts      : [5850219, 3413083, 829646, 75636923, 8298120]


Claim 150:
  Titles     : [44660616, 23704559, 11880289, 6876224, 13497630]
  Abstracts  : [5850219, 829646, 3413083, 33257464, 8298120]
  Texts      : [5850219, 829646, 3413083, 33257464, 8298120]


Claim 151:
  Titles     : [13223806, 29509926, 33986507, 27403802, 23286603]
  Abstracts  : [6397191, 29509926, 2260571, 8446259, 6144969]
  Texts      : [6397191, 29509926, 2260571, 8446259, 6144969]


Claim 152:
  Titles     : [20261352, 21700295, 8629328, 5003144, 14644164]
  Abstracts  : [20261352, 14657344, 14806256, 14644164, 44562058]
  Texts      : [20261352, 14657344, 14806256, 24596228, 9904546]


Claim 153:
  Titles     : [9724974, 1583134, 20179918, 23716150, 29429111]
  Abstracts  : [18924534, 14050257, 5519177, 1667063, 16806763]
  Texts      : [18924534, 14050257, 1667063, 5519177, 16806763]


Claim 154:
  Titles     : [30041340, 9878167, 29399239, 14853989, 17967608]
  Abstracts  : [11328820, 30041340, 17967608, 3330111, 14853989]
  Texts      : [11328820, 30041340, 17967608, 14853989, 36089763]


Claim 155:
  Titles     : [30041340, 9878167, 29399239, 14853989, 17967608]
  Abstracts  : [11328820, 14853989, 30041340, 17741440, 17967608]
  Texts      : [11328820, 14853989, 30041340, 17967608, 17741440]
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Claim 156:
  Titles    : [2033917, 11674596, 1684489, 2991954, 600808]
  Abstracts  : [2033917, 38127792, 14205246, 600808, 1684489]
  Texts     : [2033917, 38127792, 14205246, 600808, 1684489]

Claim 157:
  Titles    : [22405338, 7492420, 16839245, 3034412, 2613411]
  Abstracts  : [22405338, 7878807, 18374364, 12232678, 10165258]
  Texts     : [22405338, 7878807, 18374364, 12232678, 7560876]

Claim 158:
  Titles    : [5912283, 25104843, 7111021, 12672066, 22482820]
  Abstracts  : [5912283, 24346598, 7627167, 31554917, 4587978]
  Texts     : [5912283, 24346598, 7627167, 31554917, 7239105]

Claim 159:
  Titles    : [11614737, 24019260, 34369306, 22482820, 10617916]
  Abstracts  : [11614737, 5114940, 24019260, 5551138, 1759213]
  Texts     : [11614737, 5114940, 24019260, 5551138, 1759213]

Claim 160:
  Titles    : [14376683, 83667891, 37677954, 8979167, 22938539]
  Abstracts  : [14376683, 37677954, 83667891, 29107180, 21230110]
  Texts     : [14376683, 37677954, 83667891, 21230110, 29107180]

Claim 161:
  Titles    : [14376683, 83667891, 37677954, 14492339, 16737210]
  Abstracts  : [14376683, 83667891, 37677954, 46193478, 87986426]
  Texts     : [14376683, 83667891, 37677954, 46193478, 87986426]

Claim 162:
  Titles    : [25001628, 20707861, 47240151, 5238341, 19482914]
  Abstracts  : [25001628, 2931832, 14075252, 5238341, 21164071]
  Texts     : [25001628, 2931832, 14075252, 24670522, 5238341]

Claim 163:
  Titles    : [8331432, 3052213, 13878643, 20935673, 6401675]
  Abstracts  : [3514072, 6401675, 4632921, 2151983, 5116145]
  Texts     : [3514072, 6401675, 4632921, 2151983, 5116145]

Claim 164:
  Titles    : [1974176, 6176498, 8708082, 13282296, 44387884]
  Abstracts  : [1974176, 9822397, 10071552, 32534305, 6207111]
  Texts     : [1974176, 9822397, 10071552, 32534305, 6207111]

Claim 165:
  Titles    : [2947540, 9507605, 94109411, 38355793, 3512154]
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  Abstracts    : [5548081, 21216726, 21859699, 9539248, 708425]
  Texts      : [5548081, 21216726, 21859699, 9539248, 708425]


Claim 166:
  Titles     : [7029990, 29107180, 33835579, 24731248, 4347374]
  Abstracts    : [4709641, 15347087, 47018050, 4405194, 5953485]
  Texts      : [4709641, 15347087, 47018050, 4405194, 5953485]


Claim 167:
  Titles     : [7029990, 29107180, 33835579, 24731248, 4347374]
  Abstracts    : [4709641, 15347087, 4405194, 5953485, 13717103]
  Texts      : [4709641, 15347087, 4405194, 5953485, 13717103]


Claim 168:
  Titles     : [15048300, 32969964, 27024392, 13123189, 44586415]
  Abstracts    : [15048300, 95102458, 13625993, 23206239, 3610080]
  Texts      : [15048300, 95102458, 13625993, 3610080, 23206239]


Claim 169:
  Titles     : [15048300, 13843341, 39334724, 3752408, 32969964]
  Abstracts    : [15048300, 13843341, 16705338, 13625993, 21203899]
  Texts      : [15048300, 13843341, 16705338, 13625993, 583260]


Claim 170:
  Titles     : [8210189, 13613916, 11527822, 10300888, 4414481]
  Abstracts    : [21170174, 32638085, 9704467, 16237005, 42267740]
  Texts      : [21170174, 10874408, 42267740, 32638085, 9704467]


Claim 171:
  Titles     : [7622767, 45875990, 600808, 3056682, 24864273]
  Abstracts    : [4398832, 45875990, 600808, 17805221, 23356816]
  Texts      : [4398832, 45875990, 600808, 17805221, 23356816]


Claim 172:
  Titles     : [23887844, 3883485, 19974105, 12197393, 8502193]
  Abstracts    : [39381118, 23403754, 9588931, 10698739, 15836115]
  Texts      : [39381118, 23403754, 9588931, 10698739, 15836115]


Claim 173:
  Titles     : [8065561, 45875990, 13878643, 19099739, 39929509]
  Abstracts    : [8496132, 6828370, 24221369, 40721190, 30297355]
  Texts      : [8496132, 6828370, 40721190, 24221369, 30297355]


Claim 174:
  Titles     : [14797520, 25175223, 4162857, 32275758, 33397197]
  Abstracts    : [14797520, 34559336, 13072112, 32275758, 29788648]
  Texts      : [14797520, 32275758, 34559336, 13072112, 29788648]
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Claim 175:
  Titles    : [14797520, 25175223, 4162857, 32275758, 33397197]
  Abstracts  : [14797520, 1354567, 34559336, 13072112, 32275758]
  Texts     : [14797520, 1354567, 32275758, 34559336, 13072112]

Claim 176:
  Titles    : [24211561, 37065914, 7821634, 24190159, 935034]
  Abstracts  : [7821634, 15248287, 23403754, 20738970, 40901687]
  Texts     : [7821634, 24190159, 15248287, 23403754, 20738970]

Claim 177:
  Titles    : [29073751, 7506409, 18938992, 21562657, 7821634]
  Abstracts  : [7821634, 24190159, 29073751, 6121555, 2272614]
  Texts     : [7821634, 24190159, 29073751, 6121555, 18938992]

Claim 178:
  Titles    : [7821634, 24190159, 935034, 1797622, 23403754]
  Abstracts  : [7821634, 23403754, 37444589, 41646286, 238409]
  Texts     : [7821634, 24190159, 23403754, 37444589, 41646286]

Claim 179:
  Titles    : [14464451, 7324039, 14915566, 1544804, 6535392]
  Abstracts  : [14185503, 14464451, 13123189, 32770503, 15960670]
  Texts     : [14464451, 14185503, 32770503, 13123189, 25041967]

Claim 180:
  Titles    : [14464451, 7324039, 14915566, 1544804, 143251]
  Abstracts  : [14185503, 14464451, 13123189, 32770503, 17447653]
  Texts     : [14464451, 14185503, 32770503, 13123189, 17447653]

Claim 181:
  Titles    : [10463997, 5409325, 32766786, 33370, 27647593]
  Abstracts  : [26735905, 25576204, 10463997, 31882215, 10024681]
  Texts     : [26735905, 25576204, 10463997, 31882215, 10024681]

Claim 182:
  Titles    : [30915421, 30805636, 38401028, 8708082, 19843244]
  Abstracts  : [20732789, 9159125, 2443495, 6923961, 24828165]
  Texts     : [20732789, 9159125, 2443495, 6923961, 24828165]

Claim 183:
  Titles    : [30639847, 30058568, 25515907, 14121786, 243694]
  Abstracts  : [4506414, 30058568, 12549585, 4890578, 30639847]
  Texts     : [4506414, 30058568, 12549585, 30639847, 4890578]

Claim 184:
  Titles    : [11915280, 6334188, 142562844, 29366489, 11428884]
  Abstracts  : [22174015, 4658268, 2014909, 24612804, 19510470]
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   Texts      : [22174015, 4658268, 2014909, 24612804, 19510470]


Claim 185:
  Titles     : [29689140, 30353437, 6250701, 40349336, 2032877]
  Abstracts  : [12909503, 43192375, 40349336, 3113630, 24917562]
  Texts      : [12909503, 40349336, 43192375, 3113630, 39225849]


Claim 186:
  Titles     : [40349336, 29689140, 30353437, 24917562, 36950726]
  Abstracts  : [12909503, 43192375, 3113630, 40349336, 30353437]
  Texts      : [12909503, 40349336, 3113630, 43192375, 30353437]


Claim 187:
  Titles     : [2158516, 9505448, 24825841, 26019505, 12265561]
  Abstracts  : [9505448, 9669099, 13794374, 40145839, 23423230]
  Texts      : [9505448, 13794374, 9669099, 40145839, 23423230]


Claim 188:
  Titles     : [26019505, 12265561, 28107602, 1852826, 17123657]
  Abstracts  : [9505448, 13794374, 14461101, 9669099, 7878807]
  Texts      : [9505448, 13794374, 9669099, 14461101, 4452659]


Claim 189:
  Titles     : [29023309, 8300657, 24943534, 35651106, 20864487]
  Abstracts  : [29023309, 8300657, 798152, 20357868, 44737533]
  Texts      : [29023309, 8300657, 798152, 44737533, 20357868]


Claim 190:
  Titles     : [29023309, 8300657, 24943534, 35651106, 20864487]
  Abstracts  : [29023309, 8300657, 798152, 20357868, 44737533]
  Texts      : [29023309, 8300657, 798152, 44737533, 20357868]


Claim 191:
  Titles     : [23100962, 8536018, 26658659, 32985041, 2139357]
  Abstracts  : [25079962, 24338780, 23122306, 20381484, 21297708]
  Texts      : [25079962, 24338780, 46743299, 21297708, 2533768]


Claim 192:
  Titles     : [1780819, 43014661, 7451018, 25263942, 4767806]
  Abstracts  : [1780819, 4767806, 6121668, 9634465, 25263942]
  Texts      : [1780819, 4767806, 6121668, 9634465, 42279414]


Claim 193:
  Titles     : [4561402, 18816720, 791050, 42387637, 39559521]
  Abstracts  : [18816720, 8665891, 17454301, 2097256, 25738896]
  Texts      : [18816720, 8665891, 17454301, 42387637, 2097256]


Claim 194:
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   Titles     : [18816720, 791050, 42387637, 39559521, 17454301]
   Abstracts  : [18816720, 8665891, 17454301, 2097256, 42387637]
   Texts      : [18816720, 8665891, 17454301, 42387637, 2097256]


Claim 195:
   Titles     : [23349986, 24211561, 456304, 15948830, 36288526]
   Abstracts  : [23349986, 36288526, 24211561, 15948830, 14973286]
   Texts      : [23349986, 36288526, 24211561, 15948830, 14973286]


Claim 196:
   Titles     : [7098463, 32850528, 13580614, 32481310, 31229233]
   Abstracts  : [7098463, 5824985, 16390264, 5262240, 154243324]
   Texts      : [7098463, 5824985, 16390264, 25816994, 32850528]


Claim 197:
   Titles     : [7098463, 32850528, 13580614, 32481310, 31229233]
   Abstracts  : [7098463, 5824985, 5262240, 154243324, 3190689]
   Texts      : [7098463, 5824985, 32850528, 5262240, 43122426]


Claim 198:
   Titles     : [29253460, 19308127, 7873737, 23783727, 2842550]
   Abstracts  : [19308127, 5884524, 23783727, 38630735, 7873737]
   Texts      : [19308127, 23783727, 5884524, 44827480, 7873737]


Claim 199:
   Titles     : [23577867, 30580263, 5254463, 27772649, 935034]
   Abstracts  : [9641846, 30580263, 5254463, 1507222, 18956141]
   Texts      : [9641846, 30580263, 23577867, 5254463, 1507222]


Claim 200:
   Titles     : [4394817, 8610932, 21804115, 16826810, 3202143]
   Abstracts  : [11902109, 30714190, 26873988, 6673421, 27588420]
   Texts      : [11902109, 26873988, 30714190, 6673421, 37699461]


Claim 201:
   Titles     : [4394817, 8610932, 21804115, 16826810, 3202143]
   Abstracts  : [11902109, 26873988, 27588420, 30714190, 18450716]
   Texts      : [11902109, 26873988, 37699461, 8610932, 27588420]


Claim 202:
   Titles     : [13497630, 18344910, 9997636, 14682243, 17088791]
   Abstracts  : [13497630, 11109043, 34198460, 4423220, 17088791]
   Texts      : [13497630, 11109043, 9997636, 34198460, 17088791]


Claim 203:
   Titles     : [13036442, 5633957, 6128334, 39048693, 20179918]
   Abstracts  : [21622715, 39048693, 25263810, 2452989, 43602749]
   Texts      : [21622715, 39048693, 25263810, 1791714, 2452989]
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Claim 204:
  Titles     : [9142761, 9704467, 6128334, 39048693, 38805486]
  Abstracts  : [16167746, 18855191, 39048693, 22561064, 13277118]
  Texts      : [18855191, 16167746, 39048693, 22561064, 13277118]

Claim 205:
  Titles     : [38380061, 13936152, 28086354, 12800122, 16562534]
  Abstracts  : [9646449, 15816729, 13936152, 38380061, 12800122]
  Texts      : [9646449, 13936152, 38380061, 15816729, 12800122]

Claim 206:
  Titles     : [6144337, 31272411, 8604837, 41120293, 5519177]
  Abstracts  : [2506153, 6144337, 52095986, 37256966, 19099739]
  Texts      : [2506153, 6144337, 52095986, 37256966, 19099739]

Claim 207:
  Titles     : [18111172, 22937815, 12552297, 14446279, 17768946]
  Abstracts  : [20821402, 12207340, 12552297, 15472716, 18111172]
  Texts      : [20821402, 12207340, 12552297, 18111172, 15472716]

Claim 208:
  Titles     : [18111172, 22937815, 12552297, 14446279, 17768946]
  Abstracts  : [20821402, 12207340, 12552297, 15472716, 18111172]
  Texts      : [20821402, 12207340, 12552297, 18111172, 15472716]

Claim 209:
  Titles     : [10354110, 38587347, 29125354, 30369606, 16853734]
  Abstracts  : [38587347, 15488881, 34615397, 15058155, 9831859]
  Texts      : [38587347, 15488881, 34615397, 15058155, 10354110]

Claim 210:
  Titles     : [1071991, 35256900, 37444589, 11020556, 1933281]
  Abstracts  : [20646904, 37444589, 2389574, 20610557, 27567994]
  Texts      : [20646904, 37444589, 2389574, 20610557, 18834078]

Claim 211:
  Titles     : [16669757, 19238, 22647695, 7840442, 14893428]
  Abstracts  : [2601324, 17814815, 1550937, 34854444, 19238]
  Texts      : [2601324, 17814815, 19238, 1550937, 34854444]

Claim 212:
  Titles     : [9304312, 1554348, 21392223, 600437, 26071782]
  Abstracts  : [600437, 26019505, 6202834, 11250124, 418246]
  Texts      : [600437, 26019505, 9304312, 38919140, 418246]

Claim 213:
  Titles     : [13956305, 1388704, 24825841, 13905670, 7944381]
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  Abstracts   : [13956305, 1265945, 97884, 34481589, 8428837]
  Texts      : [13956305, 1265945, 97884, 34481589, 8428837]


Claim 214:
  Titles     : [27099731, 14831629, 25691541, 25612629, 34544514]
  Abstracts   : [27099731, 25612629, 14831629, 25691541, 9967265]
  Texts      : [27099731, 25612629, 14831629, 25691541, 9967265]


Claim 215:
  Titles     : [27099731, 14831629, 25691541, 25612629, 34544514]
  Abstracts   : [27099731, 25612629, 14831629, 25691541, 9967265]
  Texts      : [27099731, 25612629, 14831629, 25691541, 9967265]


Claim 216:
  Titles     : [9675944, 17702490, 3882374, 21601459, 35777860]
  Abstracts   : [6826100, 3882374, 30507607, 1630949, 8290760]
  Texts      : [6826100, 3882374, 30507607, 9675944, 12152977]


Claim 217:
  Titles     : [1550937, 26702468, 13794374, 3849194, 8629328]
  Abstracts   : [1550937, 7399084, 9787715, 857189, 22545779]
  Texts      : [1550937, 7399084, 9787715, 857189, 31107919]


Claim 218:
  Titles     : [1550937, 26702468, 13794374, 3849194, 8629328]
  Abstracts   : [1550937, 7399084, 9787715, 857189, 22545779]
  Texts      : [1550937, 7399084, 9787715, 857189, 31107919]


Claim 219:
  Titles     : [23915841, 4421578, 10450300, 8063697, 4373433]
  Abstracts   : [24922825, 8883846, 3566945, 1071991, 7177329]
  Texts      : [24922825, 8883846, 3566945, 7177329, 1071991]


Claim 220:
  Titles     : [1522647, 1991105, 12364109, 20459964, 34054472]
  Abstracts   : [1522647, 20459964, 21048969, 28249680, 11481946]
  Texts      : [1522647, 20459964, 21048969, 28249680, 44693226]


Claim 221:
  Titles     : [5710820, 22401061, 14337960, 15237660, 21257564]
  Abstracts   : [5710820, 17433284, 27580223, 14337960, 3929361]
  Texts      : [5710820, 17433284, 27580223, 14337960, 3929361]


Claim 222:
  Titles     : [43048059, 35768199, 1225513, 56391045, 29098525]
  Abstracts   : [18810195, 12225214, 36855703, 6788835, 14180565]
  Texts      : [18810195, 12225214, 14180565, 36855703, 6788835]
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Claim 223:
  Titles    : [16398827, 17150648, 11886686, 11742219, 4700428]
  Abstracts  : [17150648, 14782049, 2225918, 2481032, 4700428]
  Texts    : [17150648, 4700428, 14782049, 11886686, 16398827]

Claim 224:
  Titles    : [2248870, 30398773, 17097974, 44693226, 9846940]
  Abstracts  : [19005293, 21651116, 17223891, 11328820, 26068103]
  Texts    : [19005293, 21651116, 17223891, 26068103, 11328820]

Claim 225:
  Titles    : [275294, 16098747, 22843838, 38784540, 21874312]
  Abstracts  : [18340282, 27123743, 15512462, 16098747, 4886637]
  Texts    : [18340282, 27123743, 16098747, 15512462, 3524352]

Claim 226:
  Titles    : [4459491, 17717391, 26990001, 15426878, 1225513]
  Abstracts  : [17412260, 41710132, 24652030, 13814480, 15521377]
  Texts    : [24652030, 41710132, 17412260, 13814480, 15521377]

Claim 227:
  Titles    : [7285256, 51972698, 40666943, 3716075, 52072815]
  Abstracts  : [51972698, 40666943, 8582337, 32357890, 18074797]
  Texts    : [51972698, 40666943, 7285256, 8582337, 32357890]

Claim 228:
  Titles    : [1887056, 25628793, 1769799, 1148122, 26702468]
  Abstracts  : [21602220, 24019260, 1148122, 28025754, 22908536]
  Texts    : [21602220, 24019260, 1148122, 28025754, 22908536]

Claim 229:
  Titles    : [1887056, 25628793, 1769799, 1148122, 26702468]
  Abstracts  : [21602220, 24019260, 1148122, 28025754, 22908536]
  Texts    : [21602220, 24019260, 1148122, 28025754, 22908536]

Claim 230:
  Titles    : [1887056, 25628793, 1769799, 1148122, 26702468]
  Abstracts  : [21602220, 24019260, 1148122, 28025754, 22908536]
  Texts    : [21602220, 24019260, 1148122, 28025754, 22908536]

Claim 231:
  Titles    : [1769799, 1148122, 26702468, 4641348, 4394525]
  Abstracts  : [21602220, 24019260, 1148122, 28025754, 22908536]
  Texts    : [21602220, 24019260, 1148122, 28025754, 22908536]

Claim 232:
  Titles    : [2272614, 1769799, 1148122, 6212802, 22467585]
  Abstracts  : [21602220, 24019260, 1148122, 28025754, 22153455]
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  Texts     : [21602220, 24019260, 1148122, 28025754, 22908536]


Claim 233:
  Titles    : [70455704, 11360768, 4550036, 3770750, 2425364]
  Abstracts : [11360768, 70455704, 8842332, 2425364, 35714909]
  Texts     : [11360768, 70455704, 2425364, 8842332, 4550036]


Claim 234:
  Titles    : [1456068, 27768226, 154796494, 24918110, 10209731]
  Abstracts : [1456068, 10209731, 24918110, 27240667, 12438901]
  Texts     : [1456068, 10209731, 24918110, 27240667, 12438901]


Claim 235:
  Titles    : [1456068, 154796494, 24918110, 10209731, 43566999]
  Abstracts : [1456068, 10209731, 24918110, 12438901, 27240667]
  Texts     : [1456068, 10209731, 24918110, 12438901, 27240667]


Claim 236:
  Titles    : [46353045, 35987381, 20261352, 24596228, 3899896]
  Abstracts : [20261352, 40473317, 20646904, 14657344, 5752492]
  Texts     : [20261352, 40473317, 14657344, 20646904, 5752492]


Claim 237:
  Titles    : [791050, 32357890, 471921, 4695046, 16056514]
  Abstracts : [791050, 471921, 42387637, 21003930, 13770184]
  Texts     : [791050, 471921, 42387637, 21003930, 7285256]


Claim 238:
  Titles    : [22478394, 13242763, 20179918, 33986507, 57783564]
  Abstracts : [5633876, 57783564, 13242763, 28071965, 14492964]
  Texts     : [5633876, 57783564, 13242763, 28071965, 14492964]


Claim 239:
  Titles    : [29459383, 20649327, 33417012, 464511, 643765]
  Abstracts : [21150010, 18938992, 27437459, 26108767, 6421792]
  Texts     : [29459383, 27437459, 21150010, 18938992, 26108767]


Claim 240:
  Titles    : [20649327, 13923069, 22478394, 6182947, 29459383]
  Abstracts : [5132358, 21150010, 18938992, 27437459, 9278263]
  Texts     : [27437459, 5132358, 21150010, 18938992, 9278263]


Claim 241:
  Titles    : [43619625, 7492250, 164985, 32170702, 5798227]
  Abstracts : [38899659, 3118719, 32170702, 23804187, 24356383]
  Texts     : [38899659, 32170702, 3118719, 43619625, 24356383]


Claim 242:
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  Titles    : [29877890, 16626264, 13907427, 8411251, 17518195]
  Abstracts : [9451052, 8411251, 20781656, 29877890, 9889151]
  Texts     : [9451052, 8411251, 20781656, 29877890, 9889151]


Claim 243:
  Titles    : [24906548, 4709641, 6309659, 20937018, 43226130]
  Abstracts : [12443371, 4709641, 18852643, 6947286, 27076725]
  Texts     : [12443371, 4709641, 18852643, 24906548, 51386222]


Claim 244:
  Titles    : [20937018, 4505748, 32922179, 27076725, 31347396]
  Abstracts : [4709641, 12443371, 20937018, 6947286, 24530130]
  Texts     : [4709641, 12443371, 6947286, 20937018, 18852643]


Claim 245:
  Titles    : [34228604, 6309659, 24906548, 20937018, 30351165]
  Abstracts : [6309659, 12443371, 4709641, 15669393, 34228604]
  Texts     : [6309659, 4709641, 12443371, 34228604, 15669393]


Claim 246:
  Titles    : [6309659, 24906548, 30351165, 4709641, 43226130]
  Abstracts : [12443371, 4709641, 6309659, 15669393, 37205759]
  Texts     : [12443371, 4709641, 6309659, 37205759, 15669393]


Claim 247:
  Titles    : [16494316, 1917068, 35884026, 1065627, 40710501]
  Abstracts : [16494316, 17188921, 2714623, 19752008, 12785130]
  Texts     : [16494316, 17188921, 2714623, 19752008, 12785130]


Claim 248:
  Titles    : [9315213, 23397658, 22401720, 34328964, 13923069]
  Abstracts : [9315213, 7150238, 4583180, 970012, 1840993]
  Texts     : [9315213, 4583180, 7150238, 970012, 1840993]


Claim 249:
  Titles    : [14240343, 2417551, 15426878, 28647122, 2119889]
  Abstracts : [21598000, 15327601, 15983148, 28086354, 4422734]
  Texts     : [21598000, 15327601, 15983148, 35004872, 28086354]


Claim 250:
  Titles    : [19278208, 16252863, 10557471, 275294, 8595678]
  Abstracts : [42441846, 37424881, 18557974, 19278208, 8595678]
  Texts     : [42441846, 37424881, 18557974, 19278208, 8595678]


Claim 251:
  Titles    : [13791044, 33257464, 23073816, 1606628, 2352142]
  Abstracts : [33257464, 20645335, 27129115, 13791044, 1606628]
  Texts     : [33257464, 13791044, 20645335, 27129115, 23073816]
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Claim 252:
  Titles     : [29429111, 9724974, 4418582, 20738970, 2151983]
  Abstracts  : [28937856, 16728949, 83707680, 29429111, 4418070]
  Texts      : [16728949, 28937856, 29429111, 83707680, 4418070]

Claim 253:
  Titles     : [29429111, 9724974, 4418582, 18489989, 2151983]
  Abstracts  : [4418070, 83707680, 28937856, 14496749, 16728949]
  Texts      : [4418070, 29429111, 28937856, 83707680, 16728949]

Claim 254:
  Titles     : [14464451, 36540079, 27373088, 8646760, 34846352]
  Abstracts  : [36540079, 22191759, 3468459, 14464451, 25353658]
  Texts      : [36540079, 22191759, 3468459, 14464451, 5702790]

Claim 255:
  Titles     : [10993232, 19922508, 36838958, 24746892, 22696649]
  Abstracts  : [2543135, 19922508, 23887844, 29073751, 6000423]
  Texts      : [10993232, 19922508, 2543135, 36838958, 24746892]

Claim 256:
  Titles     : [31882215, 34328964, 2260571, 43890638, 11903247]
  Abstracts  : [8002887, 31882215, 3504761, 33507866, 6227220]
  Texts      : [8002887, 31882215, 33507866, 6227220, 3504761]

Claim 257:
  Titles     : [5508750, 15945975, 266641, 20179918, 23253955]
  Abstracts  : [41877386, 4418070, 13398997, 10359591, 18546584]
  Texts      : [41877386, 4418070, 18546584, 13398997, 10359591]

Claim 258:
  Titles     : [6455142, 29125354, 5508750, 15945975, 5377642]
  Abstracts  : [10359591, 41877386, 4418070, 15635366, 18546584]
  Texts      : [10359591, 41877386, 4418070, 15635366, 18546584]

Claim 259:
  Titles     : [3559136, 6417632, 6334188, 20732789, 5106691]
  Abstracts  : [2014909, 25726838, 2030623, 5836, 24612804]
  Texts      : [2014909, 25726838, 2030623, 5836, 15435343]

Claim 260:
  Titles     : [17271462, 12130067, 9911547, 7583161, 18374364]
  Abstracts  : [7583161, 10526279, 9911547, 10165258, 40234452]
  Texts      : [10526279, 7583161, 10165258, 9911547, 17271462]

Claim 261:
  Titles     : [17271462, 12130067, 13116880, 9911547, 7583161]
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  Abstracts    : [7583161, 10526279, 9911547, 16361581, 40234452]
  Texts      : [7583161, 9911547, 10526279, 17271462, 2853291]


Claim 262:
  Titles     : [2052720, 24705390, 22703082, 4387784, 29367554]
  Abstracts    : [22703082, 24705390, 2052720, 26488879, 39550665]
  Texts      : [22703082, 2052720, 24705390, 26488879, 39550665]


Claim 263:
  Titles     : [2052720, 24705390, 22703082, 4387784, 29367554]
  Abstracts    : [22703082, 2052720, 24705390, 26488879, 39550665]
  Texts      : [22703082, 2052720, 24705390, 26488879, 39550665]


Claim 264:
  Titles     : [8447873, 22547508, 3430789, 25104843, 24097933]
  Abstracts    : [33203108, 8447873, 22547508, 19132741, 41294031]
  Texts      : [33203108, 8447873, 22547508, 19132741, 24097933]


Claim 265:
  Titles     : [42950029, 38493521, 40631095, 2820454, 25301182]
  Abstracts    : [4200695, 38493521, 44586415, 42950029, 11933721]
  Texts      : [4200695, 38493521, 44586415, 42950029, 11933721]


Claim 266:
  Titles     : [38493521, 40631095, 2820454, 25301182, 1122279]
  Abstracts    : [4200695, 53779698, 2028532, 4164929, 17691617]
  Texts      : [4200695, 53779698, 40631095, 2028532, 4164929]


Claim 267:
  Titles     : [4162857, 10423989, 29828242, 21902400, 20374609]
  Abstracts    : [7860396, 10423989, 13384318, 4162857, 20585600]
  Texts      : [4162857, 10423989, 7860396, 13384318, 20585600]


Claim 268:
  Titles     : [29429111, 20179918, 17416520, 28937856, 30933307]
  Abstracts    : [30507607, 6826100, 42565477, 8290760, 26596106]
  Texts      : [30507607, 6826100, 42565477, 8290760, 26596106]


Claim 269:
  Titles     : [597790, 6227220, 70455704, 25687558, 33918970]
  Abstracts    : [597790, 52865789, 6227220, 10463997, 14116046]
  Texts      : [597790, 52865789, 6227220, 10463997, 14116046]


Claim 270:
  Titles     : [6372244, 14362678, 11915280, 33684572, 4492358]
  Abstracts    : [40096222, 15578265, 52805891, 12658073, 2565138]
  Texts      : [40096222, 15578265, 52805891, 6372244, 2604063]
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Claim 271:
  Titles     : [25536577, 9909405, 22980205, 4325398, 30658796]
  Abstracts  : [1389264, 13030852, 4325398, 25504006, 14717213]
  Texts      : [1389264, 4325398, 13030852, 25504006, 14717213]

Claim 272:
  Titles     : [15692098, 22544171, 20130904, 23267371, 42330403]
  Abstracts  : [22544171, 34747208, 15692098, 14178995, 834336]
  Texts      : [22544171, 34747208, 15692098, 14178995, 834336]

Claim 273:
  Titles     : [21767325, 13878124, 1410197, 306311, 44572913]
  Abstracts  : [15889329, 17150648, 14924526, 37592824, 44572913]
  Texts      : [15889329, 17150648, 14924526, 21767325, 37592824]

Claim 274:
  Titles     : [51706771, 195689757, 15570691, 5123516, 470625]
  Abstracts  : [12685434, 13235609, 22901758, 7028976, 13244602]
  Texts      : [12685434, 13235609, 7028976, 5123516, 15570691]

Claim 275:
  Titles     : [7185591, 26083387, 13613916, 4300851, 4463811]
  Abstracts  : [1754001, 6106004, 7185591, 4463811, 19460822]
  Texts      : [1754001, 6106004, 11527822, 7185591, 4463811]

Claim 276:
  Titles     : [20630805, 35271381, 35521287, 46277811, 42404093]
  Abstracts  : [7177329, 2601135, 10562341, 6123521, 1148122]
  Texts      : [7177329, 2601135, 10562341, 35521287, 3330111]

Claim 277:
  Titles     : [34254203, 25643818, 37182501, 2739854, 14717500]
  Abstracts  : [37182501, 42377686, 7177329, 34254203, 11359243]
  Texts      : [37182501, 34254203, 42377686, 7177329, 11359243]

Claim 278:
  Titles     : [32328114, 18256197, 6325527, 7239105, 18600579]
  Abstracts  : [6325527, 3761017, 23627419, 37065914, 18256197]
  Texts      : [6325527, 3761017, 23627419, 18256197, 37065914]

Claim 279:
  Titles     : [32328114, 18256197, 6325527, 7239105, 18600579]
  Abstracts  : [6325527, 3761017, 23627419, 37065914, 18256197]
  Texts      : [6325527, 3761017, 23627419, 18256197, 37065914]

Claim 280:
  Titles     : [8093935, 368506, 25251625, 30655442, 7357135]
  Abstracts  : [14706752, 368506, 14119470, 8093935, 5914739]
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  Texts     : [14706752, 368506, 14119470, 8093935, 25251625]


Claim 281:
  Titles    : [10991183, 8093935, 33076846, 32532238, 19482914]
  Abstracts : [10991183, 8093935, 24881307, 10530014, 32532238]
  Texts     : [10991183, 8093935, 24881307, 32532238, 10530014]


Claim 282:
  Titles    : [7465900, 29367554, 40429879, 2205779, 29190724]
  Abstracts : [22703082, 24705390, 34258065, 29367554, 4422723]
  Texts     : [24705390, 22703082, 26488879, 29367554, 34258065]


Claim 283:
  Titles    : [29877890, 8267678, 22522432, 24311787, 36831892]
  Abstracts : [12588500, 19485243, 7137057, 502591, 29877890]
  Texts     : [12588500, 7137057, 19485243, 502591, 29877890]


Claim 284:
  Titles    : [6422576, 22522432, 20960682, 8446259, 7137057]
  Abstracts : [30041340, 502591, 22522432, 25606339, 29788648]
  Texts     : [30041340, 25606339, 502591, 22522432, 7137057]


Claim 285:
  Titles    : [29877890, 8267678, 22522432, 24311787, 36831892]
  Abstracts : [12588500, 19485243, 7137057, 29877890, 175735]
  Texts     : [12588500, 19485243, 7137057, 29877890, 502591]


Claim 286:
  Titles    : [6422576, 22522432, 9483851, 25606339, 7137057]
  Abstracts : [25606339, 30041340, 22522432, 29788648, 4138659]
  Texts     : [25606339, 30041340, 22522432, 8460275, 29788648]


Claim 287:
  Titles    : [1780819, 7451018, 25263942, 42279414, 18734652]
  Abstracts : [1780819, 11359243, 6121668, 2494748, 4283694]
  Texts     : [1780819, 11359243, 6121668, 2494748, 24249915]


Claim 288:
  Titles    : [14240343, 1320137, 1259359, 2119889, 26104554]
  Abstracts : [5473074, 1320137, 22561064, 24706198, 4701662]
  Texts     : [1320137, 5473074, 22561064, 24706198, 25606339]


Claim 289:
  Titles    : [56893404, 4414547, 27162821, 3210545, 7029990]
  Abstracts : [56893404, 24269361, 15678772, 24521894, 8529693]
  Texts     : [56893404, 24269361, 15678772, 24521894, 8529693]


Claim 290:
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  Titles    : [4928057, 5106691, 13921783, 20532591, 5389523]
  Abstracts : [92499, 19583924, 9911547, 18374364, 17271462]
  Texts     : [92499, 19583924, 9911547, 18374364, 17271462]


Claim 291:
  Titles    : [14550841, 37699461, 1145473, 17119869, 5633957]
  Abstracts : [515489, 6718824, 25830701, 19583924, 22973574]
  Texts     : [515489, 6718824, 25830701, 14550841, 19583924]


Claim 292:
  Titles    : [40971746, 5558754, 20697217, 20767776, 11822354]
  Abstracts : [13223957, 34054472, 34873974, 17897801, 13350374]
  Texts     : [13223957, 34054472, 34873974, 17897801, 13350374]


Claim 293:
  Titles    : [36799998, 11887584, 1234098, 22227889, 9831859]
  Abstracts : [5548081, 22227889, 17077004, 5835149, 21216726]
  Texts     : [22227889, 5548081, 17077004, 5835149, 45461275]


Claim 294:
  Titles    : [11887584, 25293616, 1234098, 22227889, 9831859]
  Abstracts : [5548081, 22227889, 34139429, 17077004, 5835149]
  Texts     : [22227889, 5548081, 34139429, 17077004, 5835149]


Claim 295:
  Titles    : [26064662, 10608397, 21459247, 3654468, 14492339]
  Abstracts : [26064662, 12662435, 23206239, 30983338, 1538080]
  Texts     : [26064662, 12662435, 23206239, 30983338, 1538080]


Claim 296:
  Titles    : [12667988, 24285403, 50670403, 41735503, 24510595]
  Abstracts : [17930286, 6191684, 21274919, 24285403, 7239105]
  Texts     : [17930286, 6191684, 21274919, 12667988, 24285403]


Claim 297:
  Titles    : [38401028, 28845338, 5572127, 27709445, 9291668]
  Abstracts : [10883736, 38401028, 53211308, 11868606, 21053753]
  Texts     : [10883736, 38401028, 53211308, 12691537, 21003930]


Claim 298:
  Titles    : [22703082, 2638387, 39550665, 26488879, 2701077]
  Abstracts : [22703082, 2638387, 24705390, 7465900, 34436231]
  Texts     : [22703082, 2638387, 7465900, 24705390, 39550665]


Claim 299:
  Titles    : [33169058, 84244109, 21439293, 3038933, 8604837]
  Abstracts : [14853989, 40323148, 45401535, 21439293, 23117928]
  Texts     : [45401535, 14853989, 40323148, 23117928, 21439293]
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Claim 300:
  Titles    : [25516011, 30884033, 92499, 13116880, 22973574]
  Abstracts : [104143831, 14550841, 18374364, 4816339, 34982259]
  Texts     : [25516011, 104143831, 18374364, 14550841, 11900630]

Claim 301:
  Titles    : [18988265, 29564505, 2032877, 3580005, 9440748]
  Abstracts : [29564505, 20109325, 18988265, 2032877, 3580005]
  Texts     : [29564505, 20109325, 2032877, 18988265, 21287352]

Claim 302:
  Titles    : [4445629, 46277811, 6793674, 25451374, 29947146]
  Abstracts : [6793674, 33684572, 14803797, 13714201, 25822299]
  Texts     : [6793674, 33684572, 14803797, 13714201, 25822299]

Claim 303:
  Titles    : [4445629, 46277811, 6121668, 6793674, 25451374]
  Abstracts : [6793674, 33684572, 14803797, 54490092, 46277811]
  Texts     : [6793674, 33684572, 14803797, 46277811, 54490092]

Claim 304:
  Titles    : [21645205, 54561384, 3863543, 7506409, 14768471]
  Abstracts : [1617327, 3863543, 4421742, 4653837, 8724666]
  Texts     : [1617327, 3863543, 4653837, 4421742, 18489989]

Claim 305:
  Titles    : [87610599, 40087494, 27995781, 39801095, 1447990]
  Abstracts : [3360421, 11335860, 26374799, 36651210, 25413327]
  Texts     : [3360421, 11335860, 26374799, 25413327, 36651210]

Claim 306:
  Titles    : [17685207, 87610599, 40087494, 27995781, 39801095]
  Abstracts : [3360421, 11335860, 25413327, 36651210, 26374799]
  Texts     : [3360421, 11335860, 25413327, 26374799, 36651210]

Claim 307:
  Titles    : [1447990, 2437807, 3360421, 3874000, 36651210]
  Abstracts : [3360421, 25413327, 36651210, 11335860, 26374799]
  Texts     : [3360421, 25413327, 11335860, 26374799, 36651210]

Claim 308:
  Titles    : [9194077, 14419116, 14192687, 4784069, 8734695]
  Abstracts : [16056514, 21046889, 4447055, 9288638, 36637129]
  Texts     : [16056514, 21046889, 4447055, 9288638, 36637129]

Claim 309:
  Titles    : [16398827, 17150648, 11886686, 24101431, 11742219]
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  Abstracts   : [17150648, 14782049, 2225918, 2481032, 4700428]
  Texts     : [17150648, 4700428, 14782049, 2225918, 2481032]


Claim 310:
  Titles    : [19688024, 7968532, 41337677, 8417211, 59453688]
  Abstracts   : [19688024, 41337677, 7968532, 1049501, 40044800]
  Texts     : [19688024, 41337677, 7968532, 1049501, 40044800]


Claim 311:
  Titles    : [6820680, 7451018, 15419873, 1970884, 8300657]
  Abstracts   : [6820680, 5137019, 44366096, 1970884, 11784947]
  Texts     : [6820680, 5137019, 1970884, 44366096, 15419873]


Claim 312:
  Titles    : [8639034, 10648422, 13798951, 13902570, 36444198]
  Abstracts   : [10648422, 37762357, 8639034, 26068103, 15425958]
  Texts     : [10648422, 37762357, 8639034, 26068103, 9334631]


Claim 313:
  Titles    : [6070278, 20722510, 1590744, 3215494, 24998637]
  Abstracts   : [6070278, 24998637, 33118292, 11630388, 164985]
  Texts     : [6070278, 24998637, 164985, 33118292, 11630388]


Claim 314:
  Titles    : [41982985, 5914739, 25479072, 6936141, 8305686]
  Abstracts   : [8903143, 5914739, 34905328, 9283422, 41982985]
  Texts     : [8903143, 5914739, 34905328, 41982985, 9283422]


Claim 315:
  Titles    : [1471041, 14340571, 26735018, 27772649, 13578199]
  Abstracts   : [1471041, 27772649, 21060008, 10675756, 14340571]
  Texts     : [1471041, 21060008, 27772649, 10675756, 14340571]


Claim 316:
  Titles    : [9878167, 9977329, 37641175, 12956194, 14692646]
  Abstracts   : [14853989, 43054703, 9878167, 42873134, 1049501]
  Texts     : [14853989, 43054703, 9878167, 42873134, 29399239]


Claim 317:
  Titles    : [1748921, 9977329, 44693226, 23100962, 1049501]
  Abstracts   : [1049501, 20456030, 42873134, 13106686, 44693226]
  Texts     : [1049501, 20456030, 42873134, 44693226, 13106686]


Claim 318:
  Titles    : [14692646, 23388442, 28783084, 32742683, 5979056]
  Abstracts   : [2506153, 22852120, 6501747, 10190778, 5377059]
  Texts     : [30034334, 5377059, 2506153, 18275697, 9977329]
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Claim 319:
  Titles     : [33203108, 20101846, 24721347, 10766688, 2820454]
  Abstracts  : [20101846, 5152028, 56391045, 28419824, 28247027]
  Texts      : [20101846, 5152028, 57121667, 33203108, 56391045]

Claim 320:
  Titles     : [1711571, 12770738, 5698494, 44624045, 15155862]
  Abstracts  : [2867345, 25355575, 752423, 29253460, 39368721]
  Texts      : [2867345, 25355575, 752423, 27466734, 11630388]

Claim 321:
  Titles     : [6327940, 12770738, 1711571, 5698494, 44624045]
  Abstracts  : [2867345, 29253460, 8780599, 25355575, 39368721]
  Texts      : [2867345, 8780599, 29253460, 12770738, 25355575]

Claim 322:
  Titles     : [16120395, 4300851, 15551129, 26083387, 4421742]
  Abstracts  : [16120395, 12922760, 46346525, 15551129, 516867]
  Texts      : [16120395, 15551129, 26596106, 46346525, 12922760]

Claim 323:
  Titles     : [16120395, 4300851, 15551129, 26083387, 982650]
  Abstracts  : [16120395, 26596106, 46346525, 15551129, 12922760]
  Texts      : [16120395, 26596106, 15551129, 46346525, 12922760]

Claim 324:
  Titles     : [3435889, 22150633, 7581911, 13777138, 9675944]
  Abstracts  : [23418635, 6441369, 20524091, 4462419, 4423327]
  Texts      : [23418635, 6441369, 4462419, 20524091, 4423327]

Claim 325:
  Titles     : [20333864, 15832146, 1791714, 22521091, 28542402]
  Abstracts  : [20333864, 24249915, 22975806, 15832146, 20839751]
  Texts      : [20333864, 24249915, 22975806, 15832146, 20839751]

Claim 326:
  Titles     : [20333864, 1791714, 15832146, 28542402, 11861374]
  Abstracts  : [20333864, 24249915, 22975806, 20839751, 15832146]
  Texts      : [20333864, 24249915, 22975806, 15832146, 20839751]

Claim 327:
  Titles     : [25124117, 18237384, 9752604, 13400643, 16572581]
  Abstracts  : [8596357, 72159, 11784947, 13231899, 7224723]
  Texts      : [8596357, 72159, 13231899, 11784947, 7224723]

Claim 328:
  Titles     : [10300888, 13613916, 4414481, 8210189, 23604601]
  Abstracts  : [10300888, 7643848, 9704467, 34074902, 21425864]
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Texts      : [10300888, 7643848, 9704467, 13613916, 4414481]


Claim 329:
  Titles    : [10300888, 13613916, 4414481, 8210189, 23604601]
  Abstracts  : [10300888, 7643848, 32638085, 39462488, 9704467]
  Texts     : [10300888, 7643848, 32638085, 39462488, 9704467]


Claim 330:
  Titles    : [20261352, 3545805, 18231807, 14657344, 8994465]
  Abstracts  : [4468861, 8994465, 15128866, 14863011, 32787042]
  Texts     : [4468861, 8994465, 15128866, 14863011, 14657344]


Claim 331:
  Titles    : [20945963, 24408040, 5993745, 37029185, 31889025]
  Abstracts  : [37029185, 9622258, 34139429, 19675911, 8509018]
  Texts     : [37029185, 9622258, 34139429, 19675911, 24408040]


Claim 332:
  Titles    : [2682251, 6441369, 4462419, 17463549, 1336292]
  Abstracts  : [23460562, 1336292, 17463549, 14500725, 3788528]
  Texts     : [23460562, 1336292, 17463549, 14500725, 3788528]


Claim 333:
  Titles    : [14260013, 708425, 24943534, 43378932, 31560225]
  Abstracts  : [14260013, 708425, 29023309, 20864487, 31560225]
  Texts     : [14260013, 708425, 29023309, 20864487, 31560225]


Claim 334:
  Titles    : [14260013, 708425, 43378932, 24943534, 31560225]
  Abstracts  : [14260013, 708425, 43378932, 29023309, 20864487]
  Texts     : [14260013, 708425, 43378932, 29023309, 20864487]


Claim 335:
  Titles    : [21459247, 80522346, 103007, 42291761, 1449692]
  Abstracts  : [8428935, 2575938, 42291761, 41233511, 21459247]
  Texts     : [8428935, 2575938, 42291761, 41233511, 21459247]


Claim 336:
  Titles    : [40558887, 2296264, 6650933, 15563864, 6863070]
  Abstracts  : [7142113, 42855554, 2296264, 25516011, 2559303]
  Texts     : [7142113, 40558887, 42855554, 2296264, 25516011]


Claim 337:
  Titles    : [10984005, 4647303, 25451374, 980196, 16760369]
  Abstracts  : [10984005, 1068106, 752423, 1831916, 5698494]
  Texts     : [10984005, 1068106, 752423, 1831916, 5698494]


Claim 338:
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Titles     : [14682243, 32463364, 21274919, 40987633, 45457778]
Abstracts  : [14682243, 6309659, 45457778, 32463364, 13934676]
Texts      : [14682243, 6309659, 32463364, 45457778, 21274919]


Claim 339:
  Titles     : [14682243, 32463364, 21274919, 40987633, 45457778]
  Abstracts  : [14682243, 6309659, 32463364, 45457778, 13934676]
  Texts      : [14682243, 6309659, 32463364, 45457778, 13934676]

Claim 340:
  Titles     : [19675911, 20945963, 31889025, 5993745, 9056874]
  Abstracts  : [19675911, 20945963, 31889025, 36355784, 8509018]
  Texts      : [19675911, 20945963, 31889025, 36355784, 33533307]

Claim 341:
  Titles     : [4824840, 25121903, 19419439, 7547329, 52827184]
  Abstracts  : [4824840, 3776162, 17023584, 5596332, 52827184]
  Texts      : [4824840, 3776162, 17023584, 52827184, 5596332]

Claim 342:
  Titles     : [42404093, 12258338, 583260, 11254040, 16495649]
  Abstracts  : [12258338, 42404093, 583260, 11254040, 29845974]
  Texts      : [12258338, 42404093, 583260, 11254040, 29845974]

Claim 343:
  Titles     : [42404093, 12258338, 583260, 11254040, 16495649]
  Abstracts  : [12258338, 42404093, 583260, 11254040, 29845974]
  Texts      : [12258338, 42404093, 583260, 11254040, 29845974]

Claim 344:
  Titles     : [10463997, 5409325, 32766786, 27647593, 12866641]
  Abstracts  : [26735905, 25576204, 31882215, 10463997, 8425533]
  Texts      : [26735905, 25576204, 10463997, 31882215, 27647593]

Claim 345:
  Titles     : [5531479, 5612738, 24998637, 33507866, 33118292]
  Abstracts  : [6540064, 7757997, 33118292, 9814332, 28517384]
  Texts      : [6540064, 33118292, 7757997, 9814332, 11868606]

Claim 346:
  Titles     : [14407673, 30805636, 38401028, 8708082, 19843244]
  Abstracts  : [20732789, 9159125, 2443495, 6923961, 24828165]
  Texts      : [20732789, 9159125, 2443495, 6923961, 24828165]

Claim 347:
  Titles     : [30639847, 30058568, 25515907, 14121786, 23665162]
  Abstracts  : [4506414, 30058568, 12549585, 30639847, 4890578]
  Texts      : [4506414, 30058568, 12549585, 30639847, 4890578]
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Claim 348:
  Titles    : [4423203, 21439293, 37969403, 14692646, 23388442]
  Abstracts  : [21439293, 17023584, 35651106, 4664540, 7975937]
  Texts    : [21439293, 17023584, 4664540, 35651106, 14853989]

Claim 349:
  Titles    : [4423203, 21439293, 37969403, 14692646, 23388442]
  Abstracts  : [14644164, 21439293, 17023584, 5785219, 35651106]
  Texts    : [14644164, 21439293, 5785219, 17023584, 4664540]

Claim 350:
  Titles    : [1568684, 18450716, 10463997, 79447, 5106691]
  Abstracts  : [32408470, 4319174, 17933691, 36838958, 970012]
  Texts    : [32408470, 4319174, 970012, 17933691, 36838958]

Claim 351:
  Titles    : [9638032, 16056410, 8892905, 2608447, 24705390]
  Abstracts  : [9638032, 21598000, 16056410, 11983390, 34498093]
  Texts    : [9638032, 16056410, 21598000, 11983390, 34498093]

Claim 352:
  Titles    : [9638032, 28369117, 36830715, 20743803, 29785642]
  Abstracts  : [9638032, 33911859, 7549811, 28369117, 36830715]
  Texts    : [9638032, 33911859, 7549811, 28369117, 36830715]

Claim 353:
  Titles    : [9638032, 28369117, 36830715, 20743803, 29785642]
  Abstracts  : [9638032, 33911859, 7549811, 28369117, 23702805]
  Texts    : [9638032, 33911859, 7549811, 28369117, 23702805]

Claim 354:
  Titles    : [27768226, 26848994, 17911973, 24896957, 8892905]
  Abstracts  : [17911973, 22317868, 8892905, 24896957, 11255504]
  Texts    : [17911973, 22317868, 8892905, 24896957, 13072112]

Claim 355:
  Titles    : [27768226, 26848994, 17911973, 24896957, 8892905]
  Abstracts  : [17911973, 11255504, 22317868, 8892905, 21551568]
  Texts    : [17911973, 22317868, 11255504, 8892905, 25576204]

Claim 356:
  Titles    : [24541180, 4346436, 28845338, 5914739, 8903143]
  Abstracts  : [24541180, 87986426, 5914739, 8903143, 24706198]
  Texts    : [24541180, 87986426, 5914739, 623486, 8903143]

Claim 357:
  Titles    : [5500086, 39481265, 3619931, 25452937, 21884059]
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  Abstracts    : [6673421, 21258863, 9929089, 9122283, 7552215]
  Texts      : [20888849, 6673421, 21258863, 9929089, 9122283]


Claim 358:
  Titles     : [1642727, 24384587, 16180601, 7239105, 10190462]
  Abstracts    : [1642727, 4407385, 15041758, 2028532, 37156349]
  Texts      : [1642727, 15041758, 4407385, 37156349, 2028532]


Claim 359:
  Titles     : [25599283, 22843838, 4462079, 13870943, 17000834]
  Abstracts    : [25599283, 12074066, 3034412, 18557974, 4462079]
  Texts      : [25599283, 4462079, 22843838, 12074066, 3034412]


Claim 360:
  Titles     : [16826810, 21456232, 8764879, 13779605, 3773719]
  Abstracts    : [20033112, 21676556, 6082738, 8790729, 39465575]
  Texts      : [20033112, 21676556, 6082738, 54561384, 8790729]


Claim 361:
  Titles     : [16826810, 3756384, 21456232, 8764879, 13779605]
  Abstracts    : [20033112, 21676556, 14198646, 20960682, 7005276]
  Texts      : [20033112, 3847200, 3756384, 14198646, 21676556]


Claim 362:
  Titles     : [16355392, 26089649, 28207326, 7421677, 31272411]
  Abstracts    : [16355392, 22241778, 10574949, 21369472, 41599676]
  Texts      : [16355392, 22241778, 10574949, 21369472, 41599676]


Claim 363:
  Titles     : [9211173, 5468807, 30226988, 2242416, 25050364]
  Abstracts    : [5468807, 9211173, 2727303, 33370, 9638032]
  Texts      : [5468807, 9211173, 2727303, 33370, 9638032]


Claim 364:
  Titles     : [3727986, 5172048, 9507605, 1676568, 9814332]
  Abstracts    : [5172048, 9507605, 16280642, 28195565, 7583725]
  Texts      : [5172048, 9507605, 16280642, 28195565, 14591894]


Claim 365:
  Titles     : [5172048, 9507605, 27768226, 1800734, 1676568]
  Abstracts    : [5172048, 9507605, 1800734, 16280642, 28195565]
  Texts      : [5172048, 9507605, 1800734, 16280642, 28195565]


Claim 366:
  Titles     : [1686997, 21181273, 3619931, 10576136, 5137019]
  Abstracts    : [1686997, 25513319, 14198646, 30303335, 3153673]
  Texts      : [1686997, 25513319, 14198646, 19205437, 4680262]
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Claim 367:
  Titles    : [6129301, 25649714, 31019903, 20334484, 29845974]
  Abstracts  : [25649714, 6129301, 73473433, 31019903, 31612088]
  Texts     : [25649714, 6129301, 73473433, 31019903, 31612088]

Claim 368:
  Titles    : [40900567, 2460304, 7486516, 15194125, 8133050]
  Abstracts  : [6503185, 25499612, 8373753, 2460304, 40900567]
  Texts     : [6503185, 8373753, 2460304, 40900567, 25499612]

Claim 369:
  Titles    : [13619127, 22530842, 7227763, 40867854, 24408040]
  Abstracts  : [13619127, 24921368, 120626, 36799998, 41298619]
  Texts     : [13619127, 24921368, 120626, 36799998, 41298619]

Claim 370:
  Titles    : [15535511, 2481032, 1070920, 7039855, 16964262]
  Abstracts  : [17150648, 2481032, 6076903, 1070920, 15535511]
  Texts     : [32611468, 17150648, 2481032, 1070920, 6076903]

Claim 371:
  Titles    : [11705328, 19278208, 21636085, 16256507, 5152028]
  Abstracts  : [21636085, 33409100, 11705328, 37424881, 12810152]
  Texts     : [21636085, 33409100, 11705328, 37424881, 16252863]

Claim 372:
  Titles    : [11705328, 19278208, 21636085, 16256507, 5152028]
  Abstracts  : [33409100, 21636085, 11705328, 37424881, 12810152]
  Texts     : [33409100, 21636085, 11705328, 37424881, 16252863]

Claim 373:
  Titles    : [25104843, 42095718, 24625323, 44830890, 24276304]
  Abstracts  : [19945096, 15041758, 6334188, 44409062, 6767133]
  Texts     : [15041758, 19945096, 6334188, 6767133, 44409062]

Claim 374:
  Titles    : [15041758, 42095718, 3308636, 24625323, 44830890]
  Abstracts  : [44409062, 19945096, 15041758, 6334188, 6767133]
  Texts     : [15041758, 44409062, 19945096, 32012666, 6334188]

Claim 375:
  Titles    : [9278263, 12265561, 14319754, 6079486, 12789595]
  Abstracts  : [13771184, 3202143, 12789595, 36799998, 1283401]
  Texts     : [3202143, 13771184, 12789595, 9278263, 15041758]

Claim 376:
  Titles    : [10559501, 12885341, 34287602, 38376189, 16964262]
  Abstracts  : [9433958, 10559501, 4402497, 30437264, 38376189]
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  Texts     : [9433958, 10559501, 30437264, 4402497, 38376189]


Claim 377:
  Titles    : [10559501, 12885341, 34287602, 38376189, 16964262]
  Abstracts  : [9433958, 10559501, 30437264, 4402497, 38376189]
  Texts     : [9433958, 10559501, 30437264, 4402497, 38376189]


Claim 378:
  Titles    : [6853699, 7736860, 12880573, 28149602, 24998637]
  Abstracts  : [21372171, 5979056, 24384587, 28149602, 25183830]
  Texts     : [21372171, 17421851, 28149602, 6853699, 24384587]


Claim 379:
  Titles    : [4407385, 23601616, 53211308, 19912367, 9513785]
  Abstracts  : [57574395, 4407385, 6961811, 4459491, 20943272]
  Texts     : [57574395, 4407385, 6961811, 4459491, 8305686]


Claim 380:
  Titles    : [4407385, 16627684, 19912367, 9513785, 24356383]
  Abstracts  : [57574395, 4407385, 6961811, 4459491, 20943272]
  Texts     : [57574395, 4407385, 6961811, 4459491, 8305686]


Claim 381:
  Titles    : [8533245, 6422576, 26108767, 10207180, 15716328]
  Abstracts  : [8533245, 37643601, 35612665, 15716328, 26108767]
  Texts     : [8533245, 15716328, 37643601, 26108767, 35612665]


Claim 382:
  Titles    : [5293024, 6327940, 8780599, 5698494, 15155862]
  Abstracts  : [5293024, 7454794, 14803797, 5939172, 2138767]
  Texts     : [5293024, 7454794, 13230773, 14803797, 2138767]


Claim 383:
  Titles    : [37204802, 29788648, 18895793, 350542, 778436]
  Abstracts  : [37204802, 27134931, 12225214, 29788648, 16217855]
  Texts     : [37204802, 27134931, 29788648, 12225214, 16217855]


Claim 384:
  Titles    : [37204802, 40901687, 2831620, 12172346, 19658917]
  Abstracts  : [37204802, 1103795, 40901687, 350542, 2831620]
  Texts     : [37204802, 29788648, 1103795, 40901687, 350542]


Claim 385:
  Titles    : [7711685, 2359152, 3093512, 9822397, 13007205]
  Abstracts  : [22080671, 15879931, 8446259, 5979056, 7711685]
  Texts     : [22080671, 15879931, 7711685, 8446259, 5979056]


Claim 386:
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Titles      : [12580014, 4561402, 20179918, 6948886, 29429111]
Abstracts   : [12580014, 13989491, 25738896, 29785642, 39559521]
Texts       : [12580014, 13989491, 25738896, 29785642, 39559521]


Claim 387:
Titles      : [31107919, 4469125, 15488881, 41925568, 1070920]
Abstracts   : [4469125, 1070920, 45154987, 32250572, 2225918]
Texts       : [4469125, 1070920, 45154987, 32250572, 15488881]


Claim 388:
Titles      : [14386505, 6493422, 10795340, 33068577, 7948486]
Abstracts   : [6493422, 22153455, 44724517, 14407673, 33068577]
Texts       : [6493422, 22153455, 44724517, 14407673, 33068577]


Claim 389:
Titles      : [8610932, 18489989, 13759726, 26873988, 9675944]
Abstracts   : [25148216, 22150633, 1630949, 18489989, 26873988]
Texts       : [25148216, 18489989, 26873988, 22150633, 1630949]


Claim 390:
Titles      : [8610932, 18489989, 13759726, 1744097, 23418635]
Abstracts   : [25148216, 22150633, 1630949, 6446747, 18489989]
Texts       : [25148216, 22150633, 1630949, 18489989, 6446747]


Claim 391:
Titles      : [25928548, 26008063, 22800314, 10017612, 38727075]
Abstracts   : [5573975, 25928548, 40349336, 12130690, 6076903]
Texts       : [5573975, 25928548, 40349336, 22800314, 12130690]


Claim 392:
Titles      : [25928548, 26008063, 3984231, 22800314, 11868606]
Abstracts   : [5573975, 25928548, 40349336, 6076903, 39291138]
Texts       : [5573975, 25928548, 40349336, 22800314, 39291138]


Claim 393:
Titles      : [9993008, 24311787, 15635366, 4418582, 7929932]
Abstracts   : [15635366, 1791637, 13777706, 19572798, 3829232]
Texts       : [15635366, 1791637, 19572798, 13777706, 23244529]


Claim 394:
Titles      : [919007, 13290521, 2062382, 44801733, 9814332]
Abstracts   : [2095573, 9814332, 15360986, 5612738, 6540064]
Texts       : [2095573, 9814332, 5612738, 15360986, 7662206]


Claim 395:
Titles      : [14893425, 11250124, 43220289, 25148216, 8708082]
Abstracts   : [11250124, 9796495, 4350400, 22190276, 32532238]
Texts       : [11250124, 9796495, 14893425, 4350400, 22190276]
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Claim 396:
  Titles     : [14893425, 11250124, 43220289, 25148216, 14492964]
  Abstracts  : [11250124, 8006440, 9796495, 4350400, 22190276]
  Texts      : [11250124, 9796495, 8006440, 14893425, 22190276]

Claim 397:
  Titles     : [4393153, 13777706, 4411760, 23269537, 13072112]
  Abstracts  : [4162857, 4393153, 23269537, 7860396, 4411760]
  Texts      : [23269537, 4393153, 4162857, 4411760, 1695604]

Claim 398:
  Titles     : [21232018, 5939172, 1887056, 26341063, 22972632]
  Abstracts  : [6227220, 23397658, 9315213, 2832403, 14823313]
  Texts      : [6227220, 23397658, 9315213, 21232018, 2832403]

Claim 399:
  Titles     : [17421851, 4890578, 6227220, 970012, 22080671]
  Abstracts  : [9315213, 970012, 17421851, 7373453, 13923069]
  Texts      : [9315213, 970012, 4890578, 17421851, 7373453]

Claim 400:
  Titles     : [6227220, 22972632, 24356383, 3623127, 9513785]
  Abstracts  : [9315213, 23397658, 1840993, 6227220, 2832403]
  Texts      : [9315213, 6227220, 23397658, 1840993, 2832403]

Claim 401:
  Titles     : [17421851, 4890578, 970012, 22080671, 22972632]
  Abstracts  : [9315213, 7373453, 970012, 13923069, 17421851]
  Texts      : [9315213, 970012, 4890578, 7373453, 13923069]

Claim 402:
  Titles     : [34747208, 25623469, 2679511, 40760684, 17934082]
  Abstracts  : [4452659, 34747208, 22544171, 25036988, 37608303]
  Texts      : [4452659, 34747208, 25036988, 22544171, 37362689]

Claim 403:
  Titles     : [797114, 6788835, 34747208, 23985464, 26993601]
  Abstracts  : [797114, 4701662, 7643848, 37608303, 10518721]
  Texts      : [797114, 4701662, 7643848, 37608303, 10518721]

Claim 404:
  Titles     : [34747208, 25623469, 6788835, 23985464, 26993601]
  Abstracts  : [4452659, 10518721, 34747208, 22544171, 4701662]
  Texts      : [4452659, 10518721, 34747208, 22544171, 4701662]

Claim 405:
  Titles     : [34747208, 25623469, 2679511, 40760684, 17934082]
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  Abstracts   : [4452659, 34747208, 22544171, 25036988, 37608303]
  Texts     : [4452659, 25036988, 34747208, 22544171, 37362689]


Claim 406:
  Titles    : [27127885, 15337254, 39851630, 9997636, 2853291]
  Abstracts   : [25238950, 4381486, 18953920, 3848469, 23639838]
  Texts     : [25238950, 3848469, 24101431, 35811036, 4381486]


Claim 407:
  Titles    : [1071991, 35256900, 37444589, 1933281, 2389574]
  Abstracts   : [1071991, 8182950, 10190778, 27567994, 24998637]
  Texts     : [1071991, 8182950, 10190778, 27567994, 17327939]


Claim 408:
  Titles    : [16355392, 14753395, 41298619, 9641846, 40156901]
  Abstracts   : [27545868, 4423401, 2405259, 5106691, 21369472]
  Texts     : [16355392, 27545868, 2405259, 5106691, 4423401]


Claim 409:
  Titles    : [15692098, 22544171, 117907685, 18027063, 502797]
  Abstracts   : [22544171, 15692098, 34747208, 14178995, 834336]
  Texts     : [22544171, 15692098, 34747208, 14178995, 834336]


Claim 410:
  Titles    : [20402596, 20868160, 38380061, 435529, 19572798]
  Abstracts   : [16557565, 38675228, 19950357, 4350400, 20402596]
  Texts     : [16557565, 38675228, 19950357, 4350400, 20402596]


Claim 411:
  Titles    : [18276599, 14050257, 40447899, 4305576, 8267678]
  Abstracts   : [18924534, 18276599, 43711341, 9655347, 13790144]
  Texts     : [18924534, 18276599, 43711341, 9655347, 5519177]


Claim 412:
  Titles    : [22442133, 21636085, 23388442, 3748310, 34733465]
  Abstracts   : [33912748, 24269361, 22442133, 21636085, 3866315]
  Texts     : [22442133, 24269361, 33912748, 21636085, 3866315]


Claim 413:
  Titles    : [22442133, 34733465, 23388442, 4550036, 11705328]
  Abstracts   : [22442133, 24269361, 33912748, 3866315, 25974070]
  Texts     : [22442133, 24269361, 33912748, 3866315, 25974070]


Claim 414:
  Titles    : [22442133, 23388442, 34733465, 4550036, 11705328]
  Abstracts   : [33912748, 24269361, 22442133, 3866315, 25974070]
  Texts     : [33912748, 22442133, 24269361, 3866315, 20148808]
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Claim 415:
  Titles    : [2000038, 6828370, 21363424, 16550075, 9646449]
  Abstracts  : [15635366, 42314147, 6828370, 2000038, 20028729]
  Texts     : [15635366, 6828370, 42314147, 2000038, 16550075]

Claim 416:
  Titles    : [2000038, 6828370, 21363424, 16550075, 9646449]
  Abstracts  : [15635366, 6828370, 2000038, 20028729, 16550075]
  Texts     : [15635366, 6828370, 2000038, 16550075, 10024681]

Claim 417:
  Titles    : [18895793, 14658685, 8502193, 17587795, 13230773]
  Abstracts  : [17587795, 175735, 22038539, 4305576, 23208167]
  Texts     : [17587795, 175735, 22038539, 4305576, 7808055]

Claim 418:
  Titles    : [5531479, 18575183, 3155374, 5944514, 52925737]
  Abstracts  : [5531479, 4389252, 8396189, 4350400, 16128711]
  Texts     : [5531479, 4389252, 8396189, 52925737, 17934082]

Claim 419:
  Titles    : [7489663, 25148216, 36444198, 8317408, 34469966]
  Abstracts  : [22406695, 7521113, 14492339, 12370881, 36444198]
  Texts     : [22406695, 7521113, 14492339, 12370881, 36444198]

Claim 420:
  Titles    : [8548635, 4387494, 18694784, 7426741, 2817000]
  Abstracts  : [8548635, 15215393, 13400643, 15803282, 6455142]
  Texts     : [8548635, 4387494, 13400643, 18841257, 15215393]

Claim 421:
  Titles    : [2825380, 13583521, 13779605, 13902570, 21521236]
  Abstracts  : [33634749, 15551129, 37768883, 25148216, 34016987]
  Texts     : [33634749, 15551129, 25148216, 37768883, 34469966]

Claim 422:
  Titles    : [2825380, 13583521, 13779605, 13902570, 21521236]
  Abstracts  : [33634749, 15551129, 37768883, 25148216, 34016987]
  Texts     : [33634749, 15551129, 25148216, 37768883, 34469966]

Claim 423:
  Titles    : [4961038, 31324978, 21891856, 22482820, 2565138]
  Abstracts  : [4961038, 2272614, 4920376, 85665741, 28334217]
  Texts     : [4961038, 2272614, 4920376, 85665741, 28334217]

Claim 424:
  Titles    : [5389095, 24335068, 6264468, 13573143, 5821617]
  Abstracts  : [5389095, 19482914, 13573143, 20943272, 8856690]
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  Texts      : [5389095, 13573143, 24554740, 19482914, 24335068]


Claim 425:
  Titles     : [6609935, 26297042, 34735369, 15491404, 16562534]
  Abstracts  : [4417558, 6609935, 1539159, 16562534, 3506723]
  Texts      : [4417558, 6609935, 16562534, 1539159, 3506723]


Claim 426:
  Titles     : [6609935, 34735369, 26297042, 15491404, 16562534]
  Abstracts  : [4417558, 6609935, 16562534, 3506723, 29073751]
  Texts      : [4417558, 6609935, 16562534, 3506723, 29073751]


Claim 427:
  Titles     : [47240151, 20943272, 10029970, 31387717, 15893330]
  Abstracts  : [1684489, 29863668, 14205246, 16242975, 8087082]
  Texts      : [1684489, 29863668, 35531883, 14205246, 16242975]


Claim 428:
  Titles     : [23078022, 83308790, 27093166, 7005276, 24185667]
  Abstracts  : [23078022, 83308790, 39424916, 9956893, 27093166]
  Texts      : [23078022, 83308790, 39424916, 27093166, 9956893]


Claim 429:
  Titles     : [21307488, 12225214, 24725136, 24211561, 37065914]
  Abstracts  : [11291348, 9680193, 21562657, 14637235, 21307488]
  Texts      : [11291348, 21307488, 9680193, 14637235, 21562657]


Claim 430:
  Titles     : [21307488, 11291348, 12225214, 24725136, 23513818]
  Abstracts  : [11291348, 21307488, 14637235, 12225214, 9680193]
  Texts      : [11291348, 21307488, 14637235, 33068577, 12225214]


Claim 431:
  Titles     : [12225214, 24725136, 24211561, 37065914, 21307488]
  Abstracts  : [11291348, 21562657, 12225214, 29557235, 6422576]
  Texts      : [11291348, 21562657, 12225214, 23513818, 29557235]


Claim 432:
  Titles     : [12225214, 25817686, 24725136, 21307488, 23513818]
  Abstracts  : [11291348, 12225214, 29557235, 6422576, 4389394]
  Texts      : [11291348, 12225214, 29557235, 6422576, 25817686]


Claim 433:
  Titles     : [31272411, 33499189, 40608679, 2825380, 10562341]
  Abstracts  : [40608679, 28006126, 35651106, 6123924, 23804187]
  Texts      : [40608679, 28006126, 1550937, 35651106, 18231807]


Claim 434:
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   Titles     : [14692646, 19800147, 8460275, 4435369, 2242416]
   Abstracts  : [19800147, 14768471, 3588621, 4435369, 1905095]
   Texts      : [19800147, 14768471, 3588621, 4435369, 17209919]


Claim 435:
  Titles     : [19800147, 2242416, 10486817, 8460275, 31682248]
  Abstracts  : [19800147, 14768471, 3588621, 17209919, 4435369]
  Texts      : [19800147, 14768471, 3588621, 17209919, 4435369]


Claim 436:
  Titles     : [21459247, 25301182, 20931483, 2264455, 1349033]
  Abstracts  : [40900567, 8593263, 3770726, 3929361, 20999249]
  Texts      : [40900567, 8593263, 5289038, 3929361, 3770726]


Claim 437:
  Titles     : [39128592, 7451018, 3099497, 8639034, 5500086]
  Abstracts  : [31933981, 10494012, 7451018, 23122306, 25315295]
  Texts      : [31933981, 10494012, 7451018, 23122306, 25315295]


Claim 438:
  Titles     : [2714623, 33499189, 17123657, 8903143, 2617858]
  Abstracts  : [33499189, 17123657, 2617858, 2714623, 8246090]
  Texts      : [33499189, 17123657, 2617858, 2714623, 8246090]


Claim 439:
  Titles     : [3095620, 1391126, 13439128, 41239107, 27815697]
  Abstracts  : [3095620, 1391126, 27815697, 41239107, 14195528]
  Texts      : [3095620, 1391126, 27815697, 41239107, 14195528]


Claim 440:
  Titles     : [1805641, 10617916, 374902, 12409683, 13899137]
  Abstracts  : [1805641, 3929361, 13899137, 13948920, 12409683]
  Texts      : [1805641, 3929361, 13899137, 13948920, 10617916]


Claim 441:
  Titles     : [33986200, 1964163, 306311, 41644178, 11886686]
  Abstracts  : [41644178, 7997337, 1964163, 33986200, 980008]
  Texts      : [41644178, 33986200, 1964163, 7997337, 980008]


Claim 442:
  Titles     : [35087728, 2844897, 5824985, 27024392, 21884449]
  Abstracts  : [39059143, 21884449, 14395738, 5912283, 20188586]
  Texts      : [21884449, 39059143, 35087728, 14395738, 5824985]


Claim 443:
  Titles     : [4345757, 36003142, 14121786, 15790930, 33918970]
  Abstracts  : [11481946, 4353857, 1831916, 7627167, 13441037]
  Texts      : [11481946, 4345757, 4353857, 13441037, 1831916]
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Claim 444:
  Titles    : [4345757, 36003142, 37578311, 14121786, 38410121]
  Abstracts   : [23397658, 11481946, 22635278, 583260, 22534357]
  Texts    : [11481946, 23397658, 4345757, 22635278, 32777637]

Claim 445:
  Titles    : [4345757, 36003142, 37578311, 14121786, 38410121]
  Abstracts   : [22057077, 23397658, 11481946, 22635278, 583260]
  Texts    : [22057077, 11481946, 23397658, 4345757, 22635278]

Claim 446:
  Titles    : [11630388, 17124832, 22890091, 12206390, 12794099]
  Abstracts   : [2488880, 20526907, 29253460, 33835579, 15984735]
  Texts    : [2488880, 20526907, 29253460, 33835579, 15984735]

Claim 447:
  Titles    : [15476777, 2492146, 20606520, 37029185, 5500086]
  Abstracts   : [15476777, 2492146, 20606520, 9929089, 7165938]
  Texts    : [15476777, 2492146, 20606520, 9929089, 13256155]

Claim 448:
  Titles    : [39048693, 7151961, 23915841, 24922825, 4319174]
  Abstracts   : [24922825, 152245, 21150010, 8883846, 4373433]
  Texts    : [24922825, 152245, 21150010, 23915841, 8883846]

Claim 449:
  Titles    : [11569583, 43014661, 5572127, 13025574, 31293581]
  Abstracts   : [27635177, 12552297, 3173489, 11569583, 23599024]
  Texts    : [11569583, 27635177, 12552297, 3173489, 31293581]

Claim 450:
  Titles    : [11569583, 43014661, 5572127, 13025574, 31293581]
  Abstracts   : [27635177, 12552297, 3173489, 11569583, 23599024]
  Texts    : [11569583, 27635177, 12552297, 3173489, 31293581]

Claim 451:
  Titles    : [11569583, 43014661, 5572127, 13025574, 31293581]
  Abstracts   : [27635177, 12552297, 3173489, 11569583, 23599024]
  Texts    : [11569583, 27635177, 12552297, 3173489, 31293581]

Claim 452:
  Titles    : [41120293, 2481032, 195352, 597790, 120626]
  Abstracts   : [13001323, 14116046, 2481032, 6227220, 10889845]
  Texts    : [13001323, 2481032, 6227220, 14116046, 10889845]

Claim 453:
  Titles    : [2481032, 1907601, 41120293, 195352, 597790]
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  Abstracts    : [13001323, 2481032, 6227220, 43192375, 10889845]
  Texts     : [13001323, 2481032, 6227220, 43192375, 10889845]


Claim 454:
  Titles     : [8246922, 39084565, 7115651, 24338780, 854417]
  Abstracts    : [40632104, 8246922, 6270720, 24338780, 51952430]
  Texts     : [40632104, 8246922, 24338780, 6270720, 39084565]


Claim 455:
  Titles     : [20418809, 43014661, 29015485, 26688294, 23573229]
  Abstracts    : [7155555, 8246922, 39084565, 29015485, 19130782]
  Texts     : [8246922, 7155555, 39084565, 29015485, 19130782]


Claim 456:
  Titles     : [4740447, 34498325, 6426919, 8065561, 25014337]
  Abstracts    : [4740447, 4393153, 21186109, 1569031, 25543207]
  Texts     : [4740447, 4393153, 21186109, 1569031, 25014337]


Claim 457:
  Titles     : [4740447, 34498325, 6426919, 3701541, 20675284]
  Abstracts    : [4740447, 4393153, 25543207, 21186109, 1569031]
  Texts     : [4740447, 4393153, 21186109, 25543207, 1569031]


Claim 458:
  Titles     : [22647695, 12742164, 14893428, 43990286, 6325527]
  Abstracts    : [15889329, 15493354, 17991818, 17438862, 16863359]
  Texts     : [15889329, 15493354, 17991818, 16863359, 17438862]


Claim 459:
  Titles     : [22647695, 16669757, 6144337, 12742164, 43990286]
  Abstracts    : [17438862, 15889329, 17991818, 16863359, 15493354]
  Texts     : [17438862, 15889329, 16863359, 17991818, 15493354]


Claim 460:
  Titles     : [32328114, 38369817, 14566771, 18256197, 2352142]
  Abstracts    : [15984735, 23785605, 14566771, 8672737, 38369817]
  Texts     : [23785605, 15984735, 14566771, 8672737, 38369817]


Claim 461:
  Titles     : [3610080, 3662510, 4454788, 4452318, 16572581]
  Abstracts    : [3610080, 17779800, 72580164, 27711043, 3662510]
  Texts     : [3610080, 17779800, 72580164, 27711043, 3662510]


Claim 462:
  Titles     : [4399311, 24998637, 5531479, 33507866, 11401602]
  Abstracts    : [27693891, 8425533, 3107733, 5254463, 8551160]
  Texts     : [27693891, 8425533, 3107733, 8551160, 5254463]
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Claim 463:
  Titles    : [4399311, 24998637, 4939312, 15535511, 28015516]
  Abstracts : [18678095, 4701662, 20456030, 27693891, 8425533]
  Texts     : [18678095, 4701662, 20456030, 27693891, 8425533]

Claim 464:
  Titles    : [5094468, 4399311, 7736860, 24998637, 3710557]
  Abstracts : [14767844, 8425533, 8551160, 3107733, 14835068]
  Texts     : [14767844, 5094468, 12058271, 8551160, 8425533]

Claim 465:
  Titles    : [5293024, 6327940, 8780599, 5698494, 15155862]
  Abstracts : [5293024, 7454794, 5939172, 2138767, 13230773]
  Texts     : [5293024, 7454794, 13230773, 2138767, 5939172]

Claim 466:
  Titles    : [22180793, 8512633, 14131683, 27907205, 36642096]
  Abstracts : [22180793, 4373433, 7177329, 4421578, 36642096]
  Texts     : [22180793, 4373433, 7177329, 4421578, 36642096]

Claim 467:
  Titles    : [22180793, 7986878, 27907205, 36642096, 26038789]
  Abstracts : [22180793, 4373433, 36642096, 3727986, 4421578]
  Texts     : [22180793, 4373433, 7986878, 36642096, 26038789]

Claim 468:
  Titles    : [22180793, 8512633, 14131683, 27907205, 36642096]
  Abstracts : [22180793, 4373433, 7177329, 4421578, 25543207]
  Texts     : [22180793, 4373433, 7177329, 4421578, 25543207]

Claim 469:
  Titles    : [22180793, 27907205, 36642096, 26038789, 21141798]
  Abstracts : [22180793, 4373433, 6550579, 27772649, 17188921]
  Texts     : [22180793, 4373433, 6550579, 27772649, 17188921]

Claim 470:
  Titles    : [36606083, 12641252, 8654183, 4361990, 36180468]
  Abstracts : [36606083, 25787749, 19974105, 31514338, 14180217]
  Texts     : [36606083, 25787749, 19974105, 31514338, 14180217]

Claim 471:
  Titles    : [20130904, 23267371, 42330403, 37895688, 12561083]
  Abstracts : [22186938, 25041967, 14337960, 27647593, 19951373]
  Texts     : [22186938, 25041967, 60515890, 14337960, 19951373]

Claim 472:
  Titles    : [1733337, 11705328, 11428884, 22972632, 24356383]
  Abstracts : [19799455, 17081238, 5409325, 8698208, 5107861]
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  Texts     : [19799455, 17081238, 5409325, 8698208, 5107861]


Claim 473:
  Titles    : [33387953, 26019505, 24005548, 21301090, 24995939]
  Abstracts : [33387953, 21307488, 14241418, 13329980, 15322518]
  Texts     : [33387953, 21307488, 14241418, 13329980, 15322518]


Claim 474:
  Titles    : [8148304, 3572885, 23604601, 45143088, 711256]
  Abstracts : [8148304, 23604601, 19255949, 33370, 711256]
  Texts     : [8148304, 23604601, 19255949, 33370, 711256]


Claim 475:
  Titles    : [8148304, 23604601, 45143088, 145383432, 711256]
  Abstracts : [8148304, 23604601, 7662206, 19255949, 11887584]
  Texts     : [8148304, 23604601, 19255949, 7662206, 11887584]


Claim 476:
  Titles    : [9580772, 30543439, 35467590, 2601324, 16737163]
  Abstracts : [45487164, 27731651, 35467590, 25789730, 17814815]
  Texts     : [35467590, 45487164, 27731651, 25789730, 17814815]


Claim 477:
  Titles    : [26907074, 24998637, 9899292, 5531479, 33507866]
  Abstracts : [45487164, 14767844, 7840442, 35467590, 17814815]
  Texts     : [45487164, 14767844, 35467590, 7840442, 17814815]


Claim 478:
  Titles    : [15319019, 24670522, 43311750, 1605392, 8698208]
  Abstracts : [2319305, 15319019, 6426919, 25014337, 9505402]
  Texts     : [2319305, 15319019, 6426919, 25014337, 9505402]


Claim 479:
  Titles    : [15319019, 2272614, 6421792, 834336, 8417211]
  Abstracts : [2319305, 15319019, 6426919, 25014337, 2272614]
  Texts     : [15319019, 2319305, 6426919, 25014337, 2272614]


Claim 480:
  Titles    : [3430789, 140098548, 25259746, 26025370, 37248765]
  Abstracts : [26025370, 140098548, 4700428, 4678846, 7821634]
  Texts     : [26025370, 140098548, 4700428, 4678846, 7821634]


Claim 481:
  Titles    : [14584755, 3669694, 12217662, 2831620, 26008462]
  Abstracts : [4700428, 26025370, 7821634, 14584755, 3669694]
  Texts     : [4700428, 14584755, 26025370, 7821634, 3669694]


Claim 482:
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   Titles     : [24998637, 1780819, 5531479, 33507866, 11401602]
   Abstracts  : [15928989, 1780819, 6121668, 25263942, 16346504]
   Texts      : [15928989, 1780819, 6121668, 25263942, 30369606]


Claim 483:
   Titles     : [5573975, 2423940, 37269418, 4347374, 11026600]
   Abstracts  : [45166582, 23286603, 11557602, 15928989, 14803797]
   Texts      : [45166582, 23286603, 11557602, 15928989, 18852643]


Claim 484:
   Titles     : [15663829, 12451492, 68317730, 3912660, 43014661]
   Abstracts  : [34054472, 3912660, 24150328, 5567005, 68317730]
   Texts      : [3912660, 34054472, 15663829, 24150328, 5567005]


Claim 485:
   Titles     : [15663829, 12451492, 68317730, 3912660, 13923069]
   Abstracts  : [34054472, 3912660, 24150328, 68317730, 26107000]
   Texts      : [3912660, 15663829, 68317730, 34054472, 24150328]


Claim 486:
   Titles     : [30041340, 9878167, 29399239, 14853989, 17967608]
   Abstracts  : [17741440, 11328820, 30041340, 9878167, 14853989]
   Texts      : [17741440, 11328820, 30041340, 9878167, 14853989]


Claim 487:
   Titles     : [10991183, 14853989, 4423401, 7447120, 43054703]
   Abstracts  : [22696649, 2692522, 28015516, 16962732, 83667891]
   Texts      : [22696649, 2692522, 28015516, 23122306, 16962732]


Claim 488:
   Titles     : [14500725, 12258338, 6085365, 9274291, 24916604]
   Abstracts  : [14500725, 6085365, 3662510, 9274291, 409280]
   Texts      : [14500725, 6085365, 3662510, 9274291, 409280]


Claim 489:
   Titles     : [7151961, 23915841, 4319174, 4421578, 8063697]
   Abstracts  : [24922825, 152245, 8883846, 10494012, 4373433]
   Texts      : [24922825, 10494012, 152245, 23915841, 8883846]


Claim 490:
   Titles     : [12206390, 4506414, 12804937, 45218443, 30884033]
   Abstracts  : [12206390, 4506414, 25562234, 31889025, 54490092]
   Texts      : [12206390, 4506414, 25562234, 31889025, 54490092]


Claim 491:
   Titles     : [8190282, 40867854, 14361849, 38735355, 30398773]
   Abstracts  : [8190282, 40867854, 14361849, 19464037, 13843341]
   Texts      : [8190282, 40867854, 14361849, 38735355, 19464037]
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Claim 492:
  Titles     : [6407356, 27188320, 25104843, 25121903, 5402581]
  Abstracts  : [878526, 6407356, 10071590, 5836, 17438862]
  Texts      : [6407356, 878526, 28419824, 22482820, 5836]

Claim 493:
  Titles     : [6407356, 6219790, 28107602, 42404093, 3360428]
  Abstracts  : [1227277, 40127292, 18473550, 17438862, 4320424]
  Texts      : [6219790, 6407356, 40127292, 1227277, 17438862]

Claim 494:
  Titles     : [31200375, 14566771, 6650933, 16201748, 12315072]
  Abstracts  : [12315072, 22049489, 9076196, 1982286, 13048272]
  Texts      : [12315072, 22049489, 1982286, 9076196, 13048272]

Claim 495:
  Titles     : [38830961, 41913714, 72159, 3475317, 23351136]
  Abstracts  : [16066726, 8698857, 3475317, 38023457, 21258863]
  Texts      : [16066726, 8698857, 3475317, 21258863, 34615397]

Claim 496:
  Titles     : [38830961, 41913714, 3475317, 4932668, 29288582]
  Abstracts  : [16066726, 3475317, 21258863, 38830961, 40963697]
  Texts      : [16066726, 3475317, 21258863, 34615397, 38830961]

Claim 497:
  Titles     : [20568364, 16790253, 16361581, 5828251, 51728753]
  Abstracts  : [16361581, 16086778, 20568364, 17917408, 85326624]
  Texts      : [16361581, 16086778, 20568364, 17917408, 26735905]

Claim 498:
  Titles     : [37822406, 3883485, 4457834, 10546779, 15803282]
  Abstracts  : [4457834, 15803282, 3360421, 10546779, 14192687]
  Texts      : [4457834, 15803282, 10546779, 3360421, 37822406]

Claim 499:
  Titles     : [14340571, 12236208, 1022115, 10761515, 25878014]
  Abstracts  : [14340571, 10675756, 26735018, 21956124, 30041895]
  Texts      : [14340571, 10675756, 26735018, 21956124, 11415809]

Claim 500:
  Titles     : [37029185, 42913391, 24988745, 20606520, 31208367]
  Abstracts  : [43220289, 11414664, 37029185, 32421068, 24347647]
  Texts      : [43220289, 37029185, 32421068, 11414664, 24347647]

Claim 501:
  Titles     : [37029185, 42913391, 24988745, 20606520, 31208367]
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  Abstracts    : [43220289, 37029185, 32421068, 15041758, 1831916]
  Texts        : [43220289, 37029185, 32421068, 26199970, 1831916]


Claim 502:
  Titles       : [2194320, 10766688, 12364109, 3099497, 6955746]
  Abstracts    : [3095620, 313394, 6431384, 14437255, 8524891]
  Texts        : [3095620, 313394, 6431384, 14437255, 3099497]


Claim 503:
  Titles       : [7151961, 6327940, 6793674, 4319174, 23245050]
  Abstracts    : [14803797, 6327940, 33684572, 12709184, 6793674]
  Texts        : [14803797, 6327940, 33684572, 12709184, 6793674]


Claim 504:
  Titles       : [7151961, 6327940, 6793674, 4319174, 23245050]
  Abstracts    : [14803797, 6327940, 33684572, 12709184, 6793674]
  Texts        : [14803797, 6327940, 33684572, 12709184, 6793674]


Claim 505:
  Titles       : [12709184, 71341302, 7151961, 6793674, 4319174]
  Abstracts    : [14803797, 33684572, 12709184, 44624045, 6793674]
  Texts        : [14803797, 33684572, 12709184, 6793674, 44624045]


Claim 506:
  Titles       : [6477536, 44048701, 27150276, 34139429, 39281140]
  Abstracts    : [6477536, 7613033, 9754530, 9967265, 7098463]
  Texts        : [6477536, 7613033, 7098463, 9967265, 9754530]


Claim 507:
  Titles       : [6477536, 44048701, 27150276, 34139429, 39281140]
  Abstracts    : [6477536, 9754530, 9967265, 7098463, 6112053]
  Texts        : [6477536, 9754530, 7098463, 9967265, 6112053]


Claim 508:
  Titles       : [4561402, 18816720, 5811042, 791050, 42387637]
  Abstracts    : [15670968, 8665891, 10300888, 457630, 39984099]
  Texts        : [15670968, 10300888, 8665891, 457630, 18816720]


Claim 509:
  Titles       : [18816720, 791050, 42387637, 10300888, 10538985]
  Abstracts    : [15670968, 8665891, 10300888, 39984099, 18816720]
  Texts        : [15670968, 10300888, 8665891, 18816720, 39984099]


Claim 510:
  Titles       : [13509809, 38899659, 1386103, 42865134, 33507866]
  Abstracts    : [13509809, 23727313, 38899659, 25419778, 2014909]
  Texts        : [13509809, 38899659, 23727313, 25419778, 3105781]
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Claim 511:
  Titles     : [58050905, 97884, 4530659, 15365719, 665817]
  Abstracts  : [37562370, 22505710, 58050905, 33912748, 1044552]
  Texts      : [37562370, 22505710, 58050905, 33912748, 1044552]

Claim 512:
  Titles     : [36653415, 32587939, 6723450, 41915616, 9310407]
  Abstracts  : [18750453, 24269361, 19487477, 25938221, 41915616]
  Texts      : [18750453, 24269361, 19487477, 25938221, 41915616]

Claim 513:
  Titles     : [18988265, 29564505, 40935722, 25319221, 6121668]
  Abstracts  : [16686383, 14338915, 21425864, 26625002, 10189634]
  Texts      : [16686383, 14338915, 21425864, 26625002, 10189634]

Claim 514:
  Titles     : [57574395, 10641715, 4410181, 6121668, 6710699]
  Abstracts  : [16686383, 14338915, 21425864, 30675656, 2356950]
  Texts      : [16686383, 14338915, 21425864, 57574395, 30675656]

Claim 515:
  Titles     : [19688024, 44693226, 4391817, 10704438, 21295300]
  Abstracts  : [41337677, 1049501, 19688024, 7968532, 40044800]
  Texts      : [41337677, 1049501, 19688024, 7968532, 13106686]

Claim 516:
  Titles     : [44693226, 4391817, 10704438, 21295300, 13106686]
  Abstracts  : [1049501, 7968532, 41337677, 40044800, 19688024]
  Texts      : [1049501, 7968532, 41337677, 19688024, 40044800]

Claim 517:
  Titles     : [19957813, 37362689, 6061927, 25725663, 928281]
  Abstracts  : [7005276, 33912020, 4306711, 14496749, 19922508]
  Texts      : [14496749, 7005276, 33912020, 19957813, 4306711]

Claim 518:
  Titles     : [12039953, 38551172, 12451492, 6540064, 18557974]
  Abstracts  : [6540064, 33118292, 7757997, 46277811, 8997410]
  Texts      : [6540064, 33118292, 7757997, 46277811, 8997410]

Claim 519:
  Titles     : [21498497, 5372773, 10648422, 8317408, 13902570]
  Abstracts  : [10648422, 37762357, 22406695, 5372773, 26068103]
  Texts      : [10648422, 37762357, 5372773, 22406695, 34469966]

Claim 520:
  Titles     : [6923961, 2242416, 12580014, 7975937, 31634628]
  Abstracts  : [6923961, 6945691, 11915280, 14332945, 39758684]
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  Texts      : [6923961, 11915280, 6945691, 14332945, 39758684]

Claim 521:
  Titles     : [10017612, 14188138, 21957231, 11254556, 52805891]
  Abstracts  : [11254556, 10666475, 6625693, 22800314, 14188138]
  Texts      : [11254556, 10666475, 6625693, 22800314, 8536018]

Claim 522:
  Titles     : [10017612, 7552215, 21257564, 39368721, 14188138]
  Abstracts  : [11254556, 22800314, 14188138, 24632480, 14893428]
  Texts      : [11254556, 22800314, 14188138, 20128547, 30553457]

Claim 523:
  Titles     : [10017612, 33507866, 7552215, 21257564, 11401602]
  Abstracts  : [11254556, 14188138, 17967608, 37205759, 20128547]
  Texts      : [11254556, 14188138, 17967608, 20128547, 37205759]

Claim 524:
  Titles     : [87337034, 46153874, 16557565, 27768226, 17173492]
  Abstracts  : [463309, 10786948, 24541180, 1631583, 25462689]
  Texts      : [463309, 10786948, 24541180, 1631583, 25462689]

Claim 525:
  Titles     : [34071621, 20179918, 28243325, 24294572, 18895793]
  Abstracts  : [34071621, 15176526, 469066, 16364639, 6828370]
  Texts      : [34071621, 15176526, 469066, 16364639, 6828370]

Claim 526:
  Titles     : [16422880, 12145359, 17124832, 2272614, 16322674]
  Abstracts  : [16422880, 26067999, 7639744, 12145359, 34369306]
  Texts      : [16422880, 26067999, 12145359, 7639744, 34369306]

Claim 527:
  Titles     : [17077004, 57121667, 38793927, 33339202, 22227889]
  Abstracts  : [17077004, 24596228, 2758012, 25134146, 28821565]
  Texts      : [17077004, 24596228, 1259359, 2758012, 28821565]

Claim 528:
  Titles     : [17077004, 38793927, 36202354, 16760369, 57121667]
  Abstracts  : [17077004, 22414304, 25134146, 20491205, 2058909]
  Texts      : [17077004, 22414304, 36202354, 25134146, 2058909]

Claim 529:
  Titles     : [16390264, 9167230, 2488880, 3355397, 3329824]
  Abstracts  : [16390264, 5641851, 42404093, 5372432, 10374686]
  Texts      : [16390264, 5641851, 42404093, 5372432, 10374686]

Claim 530:
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  Titles     : [16390264, 9167230, 2488880, 3355397, 3329824]
  Abstracts  : [16390264, 5641851, 42404093, 5372432, 10374686]
  Texts      : [16390264, 5641851, 42404093, 5372432, 10374686]


Claim 531:
  Titles     : [18174210, 2460304, 37205685, 25938221, 40900567]
  Abstracts  : [18174210, 2460304, 25420421, 13959707, 17168045]
  Texts      : [18174210, 2460304, 25420421, 25938221, 13959707]


Claim 532:
  Titles     : [18174210, 2460304, 37205685, 4336849, 25938221]
  Abstracts  : [18174210, 2460304, 25420421, 13959707, 17168045]
  Texts      : [18174210, 2460304, 25420421, 25938221, 13959707]


Claim 533:
  Titles     : [16056514, 5260382, 4695046, 45651303, 20764484]
  Abstracts  : [16056514, 44830890, 52874170, 5260382, 24770122]
  Texts      : [16056514, 44830890, 52874170, 5260382, 24770122]


Claim 534:
  Titles     : [14711483, 23908217, 46437558, 12887068, 25041967]
  Abstracts  : [14711483, 29947146, 2360905, 10761515, 23349986]
  Texts      : [14711483, 29947146, 2360905, 10761515, 23349986]


Claim 535:
  Titles     : [28821565, 46451940, 20610390, 44562058, 23531592]
  Abstracts  : [8563659, 28821565, 3512154, 24082820, 45461275]
  Texts      : [8563659, 28821565, 3512154, 24082820, 11238951]


Claim 536:
  Titles     : [5836, 5483793, 32906513, 42421723, 4405194]
  Abstracts  : [5483793, 42693833, 18237384, 994800, 23122306]
  Texts      : [5483793, 42693833, 994800, 18237384, 23122306]


Claim 537:
  Titles     : [1921218, 6421792, 20187433, 18062308, 26973393]
  Abstracts  : [6421792, 18682109, 25895285, 6491532, 31902335]
  Texts      : [6421792, 18682109, 25895285, 6491532, 18062308]


Claim 538:
  Titles     : [9929089, 17876040, 23420807, 1065627, 20738970]
  Abstracts  : [9929089, 25895285, 2272614, 17462437, 9505402]
  Texts      : [9929089, 25895285, 2272614, 17462437, 9505402]


Claim 539:
  Titles     : [12258338, 42404093, 583260, 13843341, 11254040]
  Abstracts  : [21260231, 12258338, 16495649, 13843341, 1259359]
  Texts      : [12258338, 21260231, 16495649, 13843341, 42404093]
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Claim 540:
  Titles    : [12258338, 42404093, 583260, 13843341, 11254040]
  Abstracts  : [12258338, 21260231, 16495649, 13843341, 1259359]
  Texts     : [12258338, 21260231, 16495649, 13843341, 42404093]

Claim 541:
  Titles    : [11527199, 16737210, 11603066, 8190282, 4432763]
  Abstracts  : [7034001, 16737210, 5597586, 21859699, 14647747]
  Texts     : [7034001, 16737210, 5597586, 11527199, 21859699]

Claim 542:
  Titles    : [1642727, 7239105, 10190462, 10010651, 13083189]
  Abstracts  : [1642727, 45336190, 4407385, 10190462, 37156349]
  Texts     : [1642727, 10190462, 45336190, 4407385, 21274919]

Claim 543:
  Titles    : [18537148, 12224536, 4449524, 6876224, 10010651]
  Abstracts  : [18537148, 11201004, 13230773, 52865789, 12224536]
  Texts     : [18537148, 11201004, 13230773, 12224536, 4449524]

Claim 544:
  Titles    : [18537148, 12224536, 4449524, 6876224, 10010651]
  Abstracts  : [18537148, 11201004, 13230773, 52865789, 12224536]
  Texts     : [18537148, 11201004, 13230773, 12224536, 4449524]

Claim 545:
  Titles    : [18895793, 10010651, 13083189, 12205576, 6647414]
  Abstracts  : [41493639, 16905344, 37204802, 5172048, 13083189]
  Texts     : [16905344, 41493639, 37204802, 5172048, 13083189]

Claim 546:
  Titles    : [26047921, 1241113, 46926352, 18041692, 26297042]
  Abstracts  : [21414718, 4422723, 26047921, 2727303, 4340358]
  Texts     : [21414718, 26047921, 4422723, 2727303, 4340358]

Claim 547:
  Titles    : [3355397, 43334921, 8702697, 10024681, 27167110]
  Abstracts  : [3355397, 31229233, 24581365, 12009265, 4828631]
  Texts     : [3355397, 31229233, 24581365, 12009265, 4828631]

Claim 548:
  Titles    : [3355397, 43334921, 9831859, 17124832, 25452937]
  Abstracts  : [3355397, 31229233, 4959368, 9831859, 10430148]
  Texts     : [3355397, 31229233, 4959368, 9831859, 16630996]

Claim 549:
  Titles    : [3355397, 43334921, 8702697, 10024681, 27167110]
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  Abstracts    : [3355397, 31229233, 24581365, 12009265, 10024681]
  Texts      : [3355397, 31229233, 24581365, 10024681, 12009265]


Claim 550:
  Titles     : [14555750, 28809022, 9732010, 2151983, 13242763]
  Abstracts    : [4896726, 23208167, 11011905, 9732010, 18998807]
  Texts      : [4896726, 23208167, 11011905, 13242763, 9732010]


Claim 551:
  Titles     : [8780599, 42944505, 10209731, 25355575, 12770738]
  Abstracts    : [8780599, 6525844, 75636923, 202259, 5698494]
  Texts      : [8780599, 75636923, 6525844, 202259, 5698494]


Claim 552:
  Titles     : [13931771, 20018321, 935538, 4306711, 16242975]
  Abstracts    : [935538, 20018321, 4306711, 13931771, 16242975]
  Texts      : [935538, 13931771, 20018321, 4306711, 16242975]


Claim 553:
  Titles     : [10423989, 29828242, 4162857, 4067274, 20374609]
  Abstracts    : [21330280, 4067274, 7860396, 946756, 13384318]
  Texts      : [21330280, 4067274, 7860396, 946756, 13384318]


Claim 554:
  Titles     : [10423989, 29828242, 4162857, 4067274, 20374609]
  Abstracts    : [21330280, 4067274, 7860396, 946756, 13384318]
  Texts      : [21330280, 4067274, 7860396, 946756, 13384318]


Claim 555:
  Titles     : [2820454, 1122279, 40631095, 37037012, 26199970]
  Abstracts    : [2820454, 40817021, 25822299, 4164929, 32322418]
  Texts      : [2820454, 40817021, 40631095, 25822299, 32322418]


Claim 556:
  Titles     : [15077696, 28904104, 8577229, 9875570, 2758012]
  Abstracts    : [15077696, 11401602, 17368516, 41314611, 28904104]
  Texts      : [15077696, 11401602, 17368516, 28904104, 41314611]


Claim 557:
  Titles     : [15077696, 28904104, 8577229, 9875570, 2758012]
  Abstracts    : [15077696, 11401602, 41314611, 17368516, 28904104]
  Texts      : [15077696, 11401602, 41314611, 17368516, 28904104]


Claim 558:
  Titles     : [27446873, 27873158, 829646, 6561200, 9764256]
  Abstracts    : [27446873, 46695481, 829646, 6561200, 23136735]
  Texts      : [27446873, 46695481, 829646, 27873158, 6561200]
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Claim 559:
  Titles    : [27446873, 6561200, 7650066, 27873158, 76415938]
  Abstracts : [27446873, 6561200, 27873158, 829646, 28617573]
  Texts     : [27446873, 6561200, 27873158, 829646, 28617573]

Claim 560:
  Titles    : [11156883, 46451940, 18348376, 6407356, 1617327]
  Abstracts : [34378726, 3475317, 29509926, 343052, 20722510]
  Texts     : [34378726, 3475317, 29509926, 343052, 20722510]

Claim 561:
  Titles    : [13636631, 25726838, 6944800, 22210434, 7898952]
  Abstracts : [8702697, 120626, 29509926, 6397191, 13798951]
  Texts     : [8702697, 29509926, 21382907, 6397191, 120626]

Claim 562:
  Titles    : [13636631, 25726838, 22210434, 13613916, 7898952]
  Abstracts : [8702697, 120626, 29509926, 21382907, 6144969]
  Texts     : [8702697, 29509926, 21382907, 120626, 6144969]

Claim 563:
  Titles    : [22544171, 4416964, 1848452, 86129154, 15728433]
  Abstracts : [11659421, 16630060, 40349336, 7492250, 4457834]
  Texts     : [11659421, 16630060, 40349336, 4457834, 7506409]

Claim 564:
  Titles    : [20128547, 41822527, 4447055, 32665136, 2335873]
  Abstracts : [20128547, 2335873, 4447055, 6153754, 39532074]
  Texts     : [20128547, 4447055, 2335873, 6153754, 39532074]

Claim 565:
  Titles    : [34071621, 6828370, 20179918, 8979167, 16346504]
  Abstracts : [6828370, 16364639, 34071621, 15113221, 13964633]
  Texts     : [6828370, 34071621, 16364639, 15113221, 16346504]

Claim 566:
  Titles    : [4423220, 21479575, 1383826, 35448676, 4313478]
  Abstracts : [1383826, 27900414, 16686383, 3153673, 4411760]
  Texts     : [1383826, 27900414, 16686383, 3153673, 4411760]

Claim 567:
  Titles    : [4459491, 4427392, 12800122, 4394817, 14333540]
  Abstracts : [9988425, 23262027, 12742164, 19756935, 9675944]
  Texts     : [9988425, 12742164, 23262027, 19756935, 9675944]

Claim 568:
  Titles    : [4401289, 18263406, 39462488, 2758012, 4899981]
  Abstracts : [16472469, 4899981, 4926049, 4319844, 4444861]
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  Texts     : [16472469, 4899981, 4926049, 4319844, 4444861]


Claim 569:
  Titles    : [4767806, 15926408, 39758684, 19047331, 8774475]
  Abstracts : [16472469, 38131471, 9038803, 6812319, 4418878]
  Texts     : [16472469, 38131471, 9038803, 8774475, 4418878]


Claim 570:
  Titles    : [6710699, 13791206, 52944377, 16644043, 38252314]
  Abstracts : [16472469, 6710699, 19522248, 37762357, 13791206]
  Texts     : [16472469, 6710699, 13791206, 19522248, 12086599]


Claim 571:
  Titles    : [4468861, 12909503, 27840664, 49432306, 39225849]
  Abstracts : [16472469, 38131471, 28697248, 49432306, 11568270]
  Texts     : [16472469, 38131471, 28697248, 21439293, 11568270]


Claim 572:
  Titles    : [44172171, 30122260, 1941721, 20420780, 25462689]
  Abstracts : [16472469, 20420780, 21793890, 14178995, 27635177]
  Texts     : [16472469, 20420780, 21793890, 10874408, 27635177]


Claim 573:
  Titles    : [44172171, 30122260, 1941721, 20420780, 25462689]
  Abstracts : [16472469, 21793890, 14178995, 10015292, 27635177]
  Texts     : [16472469, 21793890, 20420780, 10874408, 27635177]


Claim 574:
  Titles    : [6710699, 13791206, 24356383, 52944377, 16644043]
  Abstracts : [16472469, 6710699, 19522248, 39637840, 24498673]
  Texts     : [16472469, 6710699, 13791206, 19522248, 38252314]


Claim 575:
  Titles    : [26607366, 14446279, 4401289, 18263406, 2758012]
  Abstracts : [25842866, 26607366, 16472469, 7468449, 18639989]
  Texts     : [26607366, 25842866, 16472469, 7468449, 18639989]


Claim 576:
  Titles    : [4343811, 8892905, 5702790, 32322418, 20696397]
  Abstracts : [5702790, 23913146, 4418112, 22623275, 29107180]
  Texts     : [5702790, 23913146, 4418112, 22623275, 29107180]


Claim 577:
  Titles    : [18895793, 778436, 3230557, 10359591, 28243325]
  Abstracts : [24624992, 11328820, 43419566, 30041340, 13011249]
  Texts     : [24624992, 11328820, 43419566, 13011249, 30041340]


Claim 578:
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Titles    : [14332945, 8577229, 5389523, 4319844, 9875570]
Abstracts  : [14332945, 8577229, 4899981, 4401289, 12086599]
Texts     : [14332945, 8577229, 4899981, 4401289, 5389523]


Claim 579:
Titles    : [3952288, 24828165, 20155713, 10162553, 39128592]
Abstracts  : [3952288, 39559521, 2734421, 13989491, 20155713]
Texts     : [3952288, 2734421, 20155713, 39559521, 39128592]


Claim 580:
Titles    : [3952288, 24828165, 20155713, 301838, 10162553]
Abstracts  : [3952288, 39559521, 2734421, 13989491, 20155713]
Texts     : [3952288, 2734421, 301838, 20155713, 39559521]


Claim 581:
Titles    : [4926049, 36816310, 40721190, 7848113, 213017]
Abstracts  : [4926049, 7848113, 40721190, 35231675, 10247314]
Texts     : [4926049, 7848113, 40721190, 10247314, 35231675]


Claim 582:
Titles    : [12580014, 14408200, 86217760, 9185195, 25853741]
Abstracts  : [14105446, 4380451, 19799455, 20279166, 4380287]
Texts     : [14105446, 19343151, 4380451, 4380287, 24155601]


Claim 583:
Titles    : [1982286, 29073751, 18938992, 21562657, 12315072]
Abstracts  : [1982286, 13048272, 12315072, 16364639, 9076196]
Texts     : [1982286, 12315072, 22049489, 13048272, 16364639]


Claim 584:
Titles    : [9745001, 43122426, 26026009, 6751418, 25452937]
Abstracts  : [9745001, 26026009, 6751418, 43122426, 37912677]
Texts     : [9745001, 26026009, 43122426, 6751418, 37912677]


Claim 585:
Titles    : [6277638, 2466614, 44562904, 797114, 1227277]
Abstracts  : [6277638, 6690087, 34760396, 15615957, 24632480]
Texts     : [6277638, 6690087, 18662787, 24632480, 34760396]


Claim 586:
Titles    : [6277638, 1227277, 13162391, 2266471, 2095573]
Abstracts  : [6277638, 10557471, 15615957, 34760396, 18557974]
Texts     : [6277638, 10557471, 15615957, 2266471, 34760396]


Claim 587:
Titles    : [11603066, 39859981, 25515662, 30379039, 12785130]
Abstracts  : [1225513, 11603066, 39859981, 4362729, 196664003]
Texts     : [1225513, 11603066, 39859981, 36962270, 4362729]
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Claim 588:
  Titles    : [16927286, 9505448, 24521894, 2479538, 1631583]
  Abstracts  : [16927286, 23342686, 22482024, 39729277, 30261663]
  Texts     : [16927286, 23342686, 22482024, 39729277, 30261663]

Claim 589:
  Titles    : [18450716, 10463997, 14637235, 79447, 5106691]
  Abstracts  : [32408470, 36838958, 17933691, 4319174, 970012]
  Texts     : [32408470, 970012, 36838958, 17933691, 4319174]

Claim 590:
  Titles    : [22185730, 11291348, 8417211, 3113630, 6157371]
  Abstracts  : [3113630, 22185730, 22500262, 6157371, 21307488]
  Texts     : [3113630, 22185730, 22500262, 6157371, 21307488]

Claim 591:
  Titles    : [22185730, 27093166, 8417211, 3113630, 6157371]
  Abstracts  : [3113630, 22185730, 16686383, 12640810, 24721866]
  Texts     : [3113630, 22185730, 16686383, 12640810, 24721866]

Claim 592:
  Titles    : [13923140, 15578265, 2388819, 23342845, 5567005]
  Abstracts  : [11899391, 13923140, 36642096, 24069089, 7115651]
  Texts     : [13923140, 11899391, 36642096, 15578265, 7115651]

Claim 593:
  Titles    : [6441369, 4462419, 4416964, 6054657, 11674288]
  Abstracts  : [4462419, 6441369, 23418635, 14923462, 3882374]
  Texts     : [6441369, 4462419, 23418635, 14923462, 3882374]

Claim 594:
  Titles    : [12486491, 45875990, 13763195, 14874811, 43752562]
  Abstracts  : [12486491, 22358449, 24863571, 935538, 18987782]
  Texts     : [12486491, 22358449, 15590539, 24863571, 935538]

Claim 595:
  Titles    : [24541180, 4346436, 5914739, 8903143, 33118292]
  Abstracts  : [24541180, 5914739, 87986426, 34905328, 8903143]
  Texts     : [24541180, 5914739, 87986426, 34905328, 623486]

Claim 596:
  Titles    : [24541180, 4346436, 5914739, 8903143, 33118292]
  Abstracts  : [24541180, 5914739, 87986426, 34905328, 8903143]
  Texts     : [24541180, 5914739, 87986426, 34905328, 623486]

Claim 597:
  Titles    : [4547102, 15803282, 7426741, 9646449, 12100854]
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  Abstracts   : [15803282, 4547102, 18998807, 14225271, 8185080]
  Texts    : [15803282, 4547102, 18998807, 14225271, 12100854]


Claim 598:
  Titles    : [4547102, 15803282, 7426741, 9646449, 12100854]
  Abstracts   : [15803282, 4547102, 18998807, 8185080, 14225271]
  Texts    : [15803282, 4547102, 18998807, 8185080, 14225271]


Claim 599:
  Titles    : [22490293, 37822406, 15803282, 6054657, 4380451]
  Abstracts   : [15803282, 8185080, 4547102, 14225271, 86129154]
  Texts    : [15803282, 22490293, 4457834, 4547102, 8185080]


Claim 600:
  Titles    : [42662816, 11615242, 26899920, 29125354, 4380451]
  Abstracts   : [16287725, 1630949, 8290760, 31882215, 22150633]
  Texts    : [16287725, 1630949, 8290760, 31882215, 11011905]


Claim 601:
  Titles    : [42662816, 11615242, 26899920, 29125354, 4380451]
  Abstracts   : [16287725, 1630949, 8290760, 31882215, 18998807]
  Texts    : [16287725, 1630949, 8290760, 31882215, 19384430]


Claim 602:
  Titles    : [9451052, 15778034, 25254425, 17518195, 5966635]
  Abstracts   : [9451052, 5966635, 11844791, 25254425, 18038955]
  Texts    : [9451052, 5966635, 11844791, 25254425, 15778034]


Claim 603:
  Titles    : [778436, 7711685, 8839502, 22309946, 13108582]
  Abstracts   : [17421851, 7711685, 7373453, 13923069, 25050364]
  Texts    : [17421851, 7711685, 7373453, 13923069, 2192419]


Claim 604:
  Titles    : [17671145, 37256966, 36889513, 14116046, 8458567]
  Abstracts   : [17671145, 22180793, 27167110, 14116046, 3203590]
  Texts    : [17671145, 22180793, 14116046, 27167110, 3203590]


Claim 605:
  Titles    : [22500262, 11565780, 4587978, 4320111, 21622715]
  Abstracts   : [22500262, 11565780, 4587978, 26099680, 11968641]
  Texts    : [22500262, 11565780, 4587978, 26099680, 11968641]


Claim 606:
  Titles    : [22500262, 11565780, 8868863, 25183830, 4587978]
  Abstracts   : [22500262, 13277039, 11565780, 3805841, 4587978]
  Texts    : [22500262, 11565780, 13277039, 4587978, 3805841]
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Claim 607:
  Titles    : [13915464, 36904081, 11420613, 2582169, 18987782]
  Abstracts  : [12486491, 22482024, 12240507, 24737389, 18987782]
  Texts    : [12486491, 22482024, 12240507, 24737389, 16712164]

Claim 608:
  Titles    : [368506, 41913714, 8093935, 11048759, 39381118]
  Abstracts  : [368506, 14706752, 9315213, 207972, 16745747]
  Texts    : [368506, 14706752, 9315213, 207972, 11721676]

Claim 609:
  Titles    : [24737389, 11935250, 12486491, 9178310, 3823862]
  Abstracts  : [24737389, 7487927, 8925851, 24450344, 11935250]
  Texts    : [24737389, 7487927, 8925851, 24450344, 11935250]

Claim 610:
  Titles    : [19878070, 26000593, 11246427, 4687948, 456304]
  Abstracts  : [26000593, 19878070, 11246427, 16812091, 17482507]
  Texts    : [26000593, 19878070, 11246427, 16812091, 17482507]

Claim 611:
  Titles    : [2097256, 3716075, 18816720, 6766459, 4810810]
  Abstracts  : [2097256, 129199129, 6766459, 3716075, 18816720]
  Texts    : [2097256, 129199129, 3716075, 6766459, 18816720]

Claim 612:
  Titles    : [2097256, 3716075, 18816720, 6766459, 4810810]
  Abstracts  : [2097256, 129199129, 3716075, 6766459, 18816720]
  Texts    : [2097256, 3716075, 129199129, 6766459, 18816720]

Claim 613:
  Titles    : [10072941, 43417006, 25451374, 45447613, 40790033]
  Abstracts  : [10072941, 2522977, 40790033, 39368721, 11939159]
  Texts    : [10072941, 2522977, 40790033, 45447613, 39368721]

Claim 614:
  Titles    : [39300105, 2276126, 2032877, 7419612, 27054878]
  Abstracts  : [13906581, 3776162, 16495649, 21323587, 39059143]
  Texts    : [13906581, 3776162, 16495649, 21323587, 39059143]

Claim 615:
  Titles    : [42950029, 38493521, 40631095, 2820454, 25301182]
  Abstracts  : [4200695, 38493521, 44586415, 42950029, 11933721]
  Texts    : [4200695, 38493521, 44586415, 42950029, 11933721]

Claim 616:
  Titles    : [13027590, 4391121, 3190689, 32462603, 30919024]
  Abstracts  : [13027590, 32462603, 12561083, 3190689, 42185082]
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  Texts     : [13027590, 32462603, 12561083, 3190689, 42185082]


Claim 617:
  Titles    : [20418809, 7602348, 19882228, 24998637, 3707035]
  Abstracts : [20418809, 16660256, 25419778, 4326318, 20186814]
  Texts     : [20418809, 16660256, 25419778, 4326318, 20186814]


Claim 618:
  Titles    : [10765888, 29947146, 8909176, 8065561, 30983338]
  Abstracts : [15659108, 15305881, 16217855, 799586, 29098525]
  Texts     : [15659108, 15305881, 16217855, 799586, 29098525]


Claim 619:
  Titles    : [47240151, 10765888, 8909176, 25536577, 20707861]
  Abstracts : [15659108, 799586, 15305881, 29098525, 16217855]
  Texts     : [15659108, 799586, 15305881, 29098525, 16217855]


Claim 620:
  Titles    : [38493521, 40631095, 2820454, 25301182, 1122279]
  Abstracts : [4200695, 53779698, 2028532, 4164929, 17691617]
  Texts     : [4200695, 53779698, 40631095, 2028532, 4164929]


Claim 621:
  Titles    : [31019903, 33135135, 154243324, 3943235, 25493293]
  Abstracts : [6129301, 154243324, 33135135, 25822299, 31019903]
  Texts     : [6129301, 33135135, 154243324, 31019903, 25822299]


Claim 622:
  Titles    : [4824840, 52827184, 15879544, 12102963, 154050141]
  Abstracts : [4824840, 3776162, 22153455, 5596332, 3878434]
  Texts     : [4824840, 3776162, 22153455, 3878434, 5596332]


Claim 623:
  Titles    : [4791384, 25121903, 52827184, 12102963, 21009874]
  Abstracts : [4824840, 3776162, 5596332, 3878434, 22153455]
  Texts     : [4824840, 3776162, 3878434, 5596332, 22153455]


Claim 624:
  Titles    : [23244529, 1332250, 20935673, 10029970, 11936877]
  Abstracts : [14658685, 16167746, 19572798, 5373138, 23244529]
  Texts     : [14658685, 16167746, 19572798, 23244529, 5373138]


Claim 625:
  Titles    : [23244529, 1332250, 20935673, 10029970, 11936877]
  Abstracts : [14658685, 16167746, 19572798, 5373138, 23244529]
  Texts     : [14658685, 16167746, 19572798, 23244529, 5373138]


Claim 626:
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  Titles     : [6309659, 38551172, 4442799, 9555784, 19205326]
  Abstracts  : [5691302, 13831842, 25973484, 1428840, 16701509]
  Texts      : [5691302, 13831842, 25973484, 1428840, 16701509]


Claim 627:
  Titles     : [37619697, 8595678, 37424881, 14566771, 37578311]
  Abstracts  : [5691302, 23627419, 8595678, 37424881, 32328114]
  Texts      : [5691302, 8595678, 23627419, 37424881, 14566771]


Claim 628:
  Titles     : [34054472, 32159283, 12130200, 17897801, 5085118]
  Abstracts  : [32159283, 5691302, 43629704, 20526907, 15984735]
  Texts      : [32159283, 5691302, 43629704, 20526907, 15984735]


Claim 629:
  Titles     : [39281140, 3981244, 5835149, 5691302, 6083952]
  Abstracts  : [39281140, 3981244, 6112053, 27466734, 5850219]
  Texts      : [39281140, 3981244, 6112053, 5850219, 27466734]


Claim 630:
  Titles     : [17628888, 12225214, 23576726, 21948782, 18237384]
  Abstracts  : [17628888, 7915836, 7645565, 23577014, 143251]
  Texts      : [17628888, 7915836, 7645565, 23577014, 143251]


Claim 631:
  Titles     : [15716328, 3118719, 46353045, 13231899, 5839365]
  Abstracts  : [40365566, 18237384, 8144920, 15425958, 2603304]
  Texts      : [18237384, 40365566, 8144920, 15425958, 46594244]


Claim 632:
  Titles     : [86129154, 4462419, 10546779, 13910150, 36921186]
  Abstracts  : [4784069, 3583084, 4457834, 14128314, 4380451]
  Texts      : [4784069, 4457834, 3583084, 86129154, 14128314]


Claim 633:
  Titles     : [39291138, 21170174, 18038250, 4422734, 25602549]
  Abstracts  : [18038250, 26851674, 18489989, 4662264, 364522]
  Texts      : [18038250, 26851674, 18489989, 4662264, 364522]


Claim 634:
  Titles     : [46353045, 154050141, 1583134, 5839365, 22130056]
  Abstracts  : [410286, 12922760, 41928290, 39729277, 42373087]
  Texts      : [410286, 41928290, 12922760, 42373087, 39729277]


Claim 635:
  Titles     : [6422576, 27373088, 31311495, 6525844, 21767325]
  Abstracts  : [3874000, 43661837, 31311495, 30884033, 5633876]
  Texts      : [3874000, 43661837, 31311495, 5633876, 30884033]
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Claim 636:
  Titles    : [4920376, 6422576, 27373088, 4325137, 31311495]
  Abstracts : [3874000, 43661837, 30884033, 31311495, 5633876]
  Texts     : [3874000, 30884033, 43661837, 31311495, 5633876]

Claim 637:
  Titles    : [3898784, 4910408, 37619697, 21571708, 9813098]
  Abstracts : [3898784, 32328114, 16760369, 5884524, 20544428]
  Texts     : [3898784, 32328114, 16760369, 5884524, 20544428]

Claim 638:
  Titles    : [6710713, 17374970, 38664102, 13933299, 11624482]
  Abstracts : [6710713, 17374970, 28017005, 24159217, 38784540]
  Texts     : [6710713, 17374970, 28017005, 24159217, 38784540]

Claim 639:
  Titles    : [6710713, 17374970, 38664102, 11624482, 29125354]
  Abstracts : [6710713, 17374970, 28017005, 12789595, 24159217]
  Texts     : [6710713, 17374970, 28017005, 12789595, 11624482]

Claim 640:
  Titles    : [7224723, 70704988, 24186125, 22544171, 39381118]
  Abstracts : [4313478, 40349336, 31324978, 52188256, 16630060]
  Texts     : [4313478, 40349336, 22544171, 756887, 31324978]

Claim 641:
  Titles    : [23117378, 2613775, 21050357, 7711685, 25301182]
  Abstracts : [23117378, 21050357, 2032877, 26341063, 21789744]
  Texts     : [23117378, 21050357, 2032877, 26341063, 21789744]

Claim 642:
  Titles    : [23117378, 2613775, 21050357, 14060030, 10993232]
  Abstracts : [1686881, 35521287, 2496002, 23117378, 21050357]
  Texts     : [1686881, 35521287, 23117378, 2496002, 21050357]

Claim 643:
  Titles    : [10450300, 10675756, 20130904, 23267371, 7151961]
  Abstracts : [12824568, 27138601, 16541762, 11943989, 27647593]
  Texts     : [12824568, 27138601, 16541762, 11943989, 27647593]

Claim 644:
  Titles    : [44048701, 19182166, 26150367, 26000593, 10474873]
  Abstracts : [44048701, 19182166, 19529370, 23704559, 11246427]
  Texts     : [44048701, 19182166, 19529370, 23704559, 11246427]

Claim 645:
  Titles    : [23351136, 718601, 20829129, 5293024, 12943966]
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  Abstracts   : [20829129, 718601, 23351136, 10247282, 3981033]
  Texts     : [20829129, 718601, 23351136, 5293024, 12943966]


Claim 646:
  Titles    : [5323845, 26710772, 13907928, 9197786, 8596837]
  Abstracts   : [5323845, 26710772, 18997216, 8596837, 13907928]
  Texts     : [5323845, 26710772, 18997216, 8596837, 13907928]


Claim 647:
  Titles    : [5323845, 26710772, 13907928, 9197786, 8596837]
  Abstracts   : [5323845, 26710772, 18997216, 13907928, 58006489]
  Texts     : [5323845, 26710772, 13907928, 18997216, 58006489]


Claim 648:
  Titles    : [2030623, 12236208, 21009874, 24917562, 25589047]
  Abstracts   : [21009874, 11481946, 11156883, 9056874, 36480032]
  Texts     : [21009874, 11481946, 9056874, 2030623, 11156883]


Claim 649:
  Titles    : [24917562, 12236208, 21009874, 1022115, 1887056]
  Abstracts   : [21009874, 11481946, 9056874, 36480032, 1032372]
  Texts     : [21009874, 11481946, 9056874, 36480032, 1032372]


Claim 650:
  Titles    : [28149602, 5448119, 28015516, 14938990, 15155862]
  Abstracts   : [28149602, 12670680, 28015516, 27466734, 1049501]
  Texts     : [28149602, 5448119, 28015516, 12670680, 27466734]


Claim 651:
  Titles    : [21746539, 306006, 7869794, 4389252, 41982985]
  Abstracts   : [6936141, 15972906, 41982985, 4422734, 4389252]
  Texts     : [6936141, 15972906, 41982985, 4389252, 7869794]


Claim 652:
  Titles    : [24142891, 19756935, 13244602, 25510546, 23929297]
  Abstracts   : [24142891, 19756935, 10086360, 27588420, 13779605]
  Texts     : [24142891, 19756935, 27588420, 10086360, 25510546]


Claim 653:
  Titles    : [24282306, 470625, 7898952, 11968641, 33638477]
  Abstracts   : [33370, 22901758, 18600579, 13235609, 37686718]
  Texts     : [33370, 22901758, 7898952, 18600579, 13235609]


Claim 654:
  Titles    : [470625, 7898952, 9791313, 29366489, 25726838]
  Abstracts   : [33370, 18600579, 22901758, 470625, 37686718]
  Texts     : [33370, 18600579, 470625, 7898952, 22901758]
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Claim 655:
  Titles     : [24282306, 470625, 7898952, 11968641, 33638477]
  Abstracts  : [33370, 22901758, 18600579, 13235609, 37686718]
  Texts      : [33370, 22901758, 7898952, 18600579, 13235609]

Claim 656:
  Titles     : [43619625, 7492250, 25915873, 32170702, 10165258]
  Abstracts  : [3531388, 24356383, 10795340, 11716783, 38899659]
  Texts      : [3531388, 24356383, 10795340, 12130067, 11716783]

Claim 657:
  Titles     : [27167110, 12009265, 308862, 20454006, 12074066]
  Abstracts  : [12009265, 24581365, 8512633, 25915873, 25513319]
  Texts      : [12009265, 24581365, 8512633, 25915873, 25513319]

Claim 658:
  Titles     : [12009265, 520579, 38551172, 12074066, 27167110]
  Abstracts  : [12009265, 30720103, 39174007, 38551172, 10699587]
  Texts      : [12009265, 30720103, 38551172, 39174007, 10699587]

Claim 659:
  Titles     : [5260382, 12364109, 6123521, 6036535, 25452937]
  Abstracts  : [5260382, 9194077, 15347087, 7221410, 10207180]
  Texts      : [5260382, 9194077, 15347087, 4407385, 7221410]

Claim 660:
  Titles     : [10071552, 9822397, 3770750, 12224536, 32534305]
  Abstracts  : [10071552, 9822397, 33960383, 12224536, 27449472]
  Texts      : [10071552, 9822397, 12224536, 33960383, 3770750]

Claim 661:
  Titles     : [103007, 22635278, 13025574, 19205326, 12207167]
  Abstracts  : [4828631, 18340282, 21547032, 19205326, 5222182]
  Texts      : [4828631, 18340282, 19205326, 21547032, 103007]

Claim 662:
  Titles     : [7370282, 8596357, 12885341, 11020556, 2248870]
  Abstracts  : [7370282, 5700349, 8563659, 2603304, 3825472]
  Texts      : [7370282, 5700349, 2603304, 8596357, 8563659]

Claim 663:
  Titles     : [22922353, 38752049, 40949706, 1428830, 7547329]
  Abstracts  : [7098463, 40949706, 35495268, 24917562, 22922353]
  Texts      : [7098463, 40949706, 22922353, 24917562, 35495268]

Claim 664:
  Titles     : [21902400, 30543439, 21323587, 8842332, 935034]
  Abstracts  : [40127292, 44265107, 13083189, 2344892, 31612088]
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  Texts     : [40127292, 12584053, 44265107, 13083189, 31612088]

Claim 665:
  Titles    : [21902400, 21323587, 8842332, 935034, 24088502]
  Abstracts : [2787558, 1456068, 12584053, 36033696, 11360768]
  Texts     : [12584053, 2787558, 1456068, 36033696, 11360768]

Claim 666:
  Titles    : [21902400, 22922353, 38752049, 40949706, 31208367]
  Abstracts : [43220289, 40949706, 7098463, 6841927, 38752049]
  Texts     : [43220289, 40949706, 39264456, 12584053, 38752049]

Claim 667:
  Titles    : [18489989, 4421787, 4366738, 36398420, 13889962]
  Abstracts : [11902109, 23269537, 4417177, 4366738, 38919140]
  Texts     : [11902109, 4417177, 4366738, 23269537, 38919140]

Claim 668:
  Titles    : [15305881, 46305977, 8646760, 11844826, 19966976]
  Abstracts : [15305881, 29877890, 38300781, 11844826, 26993601]
  Texts     : [15305881, 29877890, 38300781, 11844826, 8646760]

Claim 669:
  Titles    : [1243475, 4312169, 834336, 13883546, 14717500]
  Abstracts : [28614776, 9791313, 23269537, 12887068, 7426741]
  Texts     : [28614776, 9791313, 23269537, 12887068, 7426741]

Claim 670:
  Titles    : [1243475, 4312169, 834336, 13883546, 14717500]
  Abstracts : [28614776, 9791313, 23269537, 12887068, 7426741]
  Texts     : [28614776, 9791313, 23269537, 12887068, 7426741]

Claim 671:
  Titles    : [29877890, 13907427, 8411251, 12156187, 20781656]
  Abstracts : [9889151, 8411251, 9451052, 406733, 20781656]
  Texts     : [9889151, 8411251, 9451052, 406733, 20781656]

Claim 672:
  Titles    : [8563659, 22309946, 18574146, 23531592, 31560225]
  Abstracts : [40584205, 8563659, 12966719, 5735492, 18574146]
  Texts     : [8563659, 40584205, 18574146, 5735492, 12966719]

Claim 673:
  Titles    : [1568684, 29381091, 40232172, 43192375, 52865789]
  Abstracts : [4319174, 14865329, 29381091, 52865789, 4854076]
  Texts     : [4319174, 14865329, 52865789, 29381091, 4854076]

Claim 674:
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  Titles    : [18956141, 3973445, 4447785, 20054396, 46305977]
  Abstracts : [18956141, 4447785, 83308790, 22210434, 23078022]
  Texts     : [18956141, 4447785, 83308790, 23078022, 22210434]


Claim 675:
  Titles    : [18956141, 3973445, 4447785, 14145440, 20054396]
  Abstracts : [18956141, 7735859, 83308790, 22210434, 4447785]
  Texts     : [18956141, 4447785, 83308790, 7735859, 22210434]


Claim 676:
  Titles    : [7370282, 12885341, 29504413, 368506, 13639330]
  Abstracts : [7370282, 8563659, 2603304, 12885341, 6767271]
  Texts     : [7370282, 12885341, 2603304, 8563659, 6767271]


Claim 677:
  Titles    : [2739854, 36540079, 8646760, 12451492, 20943272]
  Abstracts : [15419873, 38899659, 10627801, 16058322, 22191759]
  Texts     : [15419873, 38899659, 10627801, 16058322, 9169645]


Claim 678:
  Titles    : [13955536, 13910150, 1910120, 40087494, 9993008]
  Abstracts : [13910150, 13955536, 4423327, 1649738, 5448119]
  Texts     : [13910150, 13955536, 4423327, 1649738, 5448119]


Claim 679:
  Titles    : [13955536, 40087494, 7736860, 9784254, 2888272]
  Abstracts : [13910150, 4423327, 22428640, 13955536, 1649738]
  Texts     : [13910150, 13955536, 4423327, 22428640, 1649738]


Claim 680:
  Titles    : [19658917, 20943272, 2566674, 16058322, 1546650]
  Abstracts : [6144337, 10627801, 16058322, 23342686, 22191759]
  Texts     : [6144337, 10627801, 16058322, 23342686, 22191759]


Claim 681:
  Titles    : [39128592, 3952288, 24828165, 20155713, 10162553]
  Abstracts : [3952288, 39128592, 301838, 2734421, 32906513]
  Texts     : [3952288, 39128592, 301838, 2734421, 24828165]


Claim 682:
  Titles    : [8909176, 14541844, 10300888, 32712381, 13613916]
  Abstracts : [8909176, 13613916, 14541844, 32712381, 1631583]
  Texts     : [13613916, 8909176, 14541844, 32712381, 4414481]


Claim 683:
  Titles    : [22067786, 1967017, 13906892, 368506, 40367499]
  Abstracts : [1967017, 36242796, 22505190, 27408104, 9769310]
  Texts     : [1967017, 36242796, 27408104, 22505190, 13069283]
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Claim 684:
  Titles    : [16737210, 41774099, 21859699, 21377587, 23377475]
  Abstracts  : [16737210, 21859699, 41774099, 21203899, 7034001]
  Texts     : [16737210, 21859699, 41774099, 21203899, 7034001]

Claim 685:
  Titles    : [4432763, 6490571, 27391365, 2338488, 7838799]
  Abstracts  : [30844602, 51972698, 45218443, 7485455, 2338488]
  Texts     : [30844602, 2338488, 4432763, 51972698, 45218443]

Claim 686:
  Titles    : [38502066, 23418635, 4394817, 44420873, 9283422]
  Abstracts  : [41710132, 7688110, 4394817, 9641846, 28697248]
  Texts     : [41710132, 7688110, 4394817, 9641846, 28697248]

Claim 687:
  Titles    : [24552097, 22937815, 12552297, 14446279, 28707489]
  Abstracts  : [86704258, 275294, 32421068, 14482051, 36355784]
  Texts     : [86704258, 32421068, 275294, 14482051, 36355784]

Claim 688:
  Titles    : [13944805, 19205437, 18084826, 39187170, 41310252]
  Abstracts  : [39187170, 79447, 19205437, 41790911, 5687200]
  Texts     : [39187170, 79447, 19205437, 41790911, 5687200]

Claim 689:
  Titles    : [47240151, 17123657, 1631583, 40760684, 4422734]
  Abstracts  : [23938319, 26283293, 5473074, 12149169, 22191759]
  Texts     : [23938319, 26283293, 12149169, 5473074, 22191759]

Claim 690:
  Titles    : [20887554, 27054878, 14652521, 17462437, 19673227]
  Abstracts  : [5558754, 23983289, 654735, 54440, 8963413]
  Texts     : [5558754, 23983289, 27054878, 654735, 18654430]

Claim 691:
  Titles    : [27061085, 5403286, 10342807, 40090058, 21114100]
  Abstracts  : [18909530, 46277811, 40090058, 13123189, 27061085]
  Texts     : [18909530, 27061085, 46277811, 40090058, 5403286]

Claim 692:
  Titles    : [37444589, 1071991, 2389574, 35256900, 27403802]
  Abstracts  : [2291922, 15425958, 1933281, 2389574, 24998637]
  Texts     : [2291922, 1933281, 15425958, 37444589, 12489688]

Claim 693:
  Titles    : [7451018, 2638387, 6820680, 544971, 15617866]
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Abstracts    : [4347374, 544971, 2638387, 14376683, 4231060]
Texts      : [2638387, 544971, 4347374, 14376683, 12552297]


Claim 694:
  Titles    : [35764259, 22210434, 20722510, 12705056, 13636631]
  Abstracts   : [4928282, 32665136, 35764259, 13636631, 9159125]
  Texts     : [4928282, 35764259, 13636631, 32665136, 9159125]


Claim 695:
  Titles    : [35764259, 22210434, 20722510, 12705056, 13636631]
  Abstracts   : [4928282, 20460020, 35764259, 13636631, 9159125]
  Texts     : [4928282, 35764259, 13636631, 20460020, 9159125]


Claim 696:
  Titles    : [4767806, 38811597, 26107000, 46485368, 3285059]
  Abstracts   : [17934603, 23901235, 36444198, 21498497, 22890091]
  Texts     : [17934603, 23901235, 21498497, 36444198, 22890091]


Claim 697:
  Titles    : [13905670, 7489663, 25148216, 36444198, 36799998]
  Abstracts   : [17934603, 36444198, 4418878, 2192419, 13905670]
  Texts     : [13905670, 36444198, 17934603, 4418878, 10648422]


Claim 698:
  Titles    : [16355392, 14753395, 41298619, 14637235, 17691617]
  Abstracts   : [27545868, 4423401, 5106691, 16355392, 21369472]
  Texts     : [16355392, 27545868, 4423401, 5106691, 21369472]


Claim 699:
  Titles    : [18914652, 17768946, 13921783, 15655418, 14581009]
  Abstracts   : [3829232, 2423940, 6268106, 14581009, 29467201]
  Texts     : [3829232, 2423940, 6268106, 14581009, 18914652]


Claim 700:
  Titles    : [28937856, 29429111, 14402338, 21383026, 21931005]
  Abstracts   : [29429111, 17055665, 9393969, 4418070, 1576955]
  Texts     : [29429111, 17055665, 9393969, 4418070, 3748310]


Claim 701:
  Titles    : [5765455, 19922508, 10993232, 24746892, 22696649]
  Abstracts   : [13023410, 1941721, 35543846, 4391121, 5765455]
  Texts     : [13023410, 5765455, 1941721, 35543846, 22696649]


Claim 702:
  Titles    : [7968532, 9784254, 14853989, 21535641, 3107733]
  Abstracts   : [5289038, 26474812, 6144337, 24157077, 3001685]
  Texts     : [5289038, 26474812, 6144337, 24157077, 3001685]
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Claim 703:
  Titles     : [26873988, 21932050, 26133404, 25141908, 30933307]
  Abstracts  : [26873988, 21932050, 30933307, 25141908, 5372773]
  Texts      : [26873988, 21932050, 30933307, 25141908, 10450300]

Claim 704:
  Titles     : [25806385, 5487448, 27129115, 30786800, 22815457]
  Abstracts  : [25641414, 7662395, 881332, 13097856, 9976969]
  Texts      : [25641414, 7662395, 881332, 13097856, 25806385]

Claim 705:
  Titles     : [25806385, 13714201, 5487448, 27129115, 30786800]
  Abstracts  : [25641414, 7662395, 13097856, 881332, 30786800]
  Texts      : [25641414, 7662395, 13097856, 881332, 25806385]

Claim 706:
  Titles     : [1871230, 16863359, 4417558, 1676568, 34198365]
  Abstracts  : [1676568, 20943272, 22505710, 3093512, 343052]
  Texts      : [1676568, 20943272, 22505710, 3093512, 36345185]

Claim 707:
  Titles     : [36242796, 29073751, 18938992, 24144677, 21562657]
  Abstracts  : [13905670, 6144969, 28937856, 12443371, 343052]
  Texts      : [13905670, 6144969, 28937856, 12443371, 36242796]

Claim 708:
  Titles     : [2844490, 4427060, 5922085, 7735859, 9244474]
  Abstracts  : [13905670, 1265945, 24906548, 5922085, 6957332]
  Texts      : [13905670, 5922085, 1265945, 24906548, 6957332]

Claim 709:
  Titles     : [43534665, 10450300, 24144677, 7281161, 7944381]
  Abstracts  : [13905670, 28937856, 12443371, 37762357, 26068103]
  Texts      : [13905670, 28937856, 12443371, 37762357, 26068103]

Claim 710:
  Titles     : [26902591, 29381091, 20532591, 5106691, 38023457]
  Abstracts  : [14865329, 29381091, 4319174, 1568684, 4854076]
  Texts      : [14865329, 29381091, 1568684, 4319174, 4854076]

Claim 711:
  Titles     : [26902591, 29381091, 20532591, 5106691, 38023457]
  Abstracts  : [14865329, 29381091, 4319174, 1568684, 4854076]
  Texts      : [14865329, 29381091, 1568684, 4319174, 4854076]

Claim 712:
  Titles     : [42404093, 6070278, 583260, 46277811, 11254040]
  Abstracts  : [3654468, 38630735, 11939159, 27665523, 8780599]
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  Texts     : [3654468, 38630735, 46277811, 11939159, 6070278]


Claim 713:
  Titles    : [42404093, 583260, 11254040, 12258338, 6070278]
  Abstracts  : [3654468, 37628989, 11254040, 15968271, 5551138]
  Texts     : [3654468, 37628989, 11254040, 15968271, 583260]

Claim 714:
  Titles    : [17991818, 1905095, 39164524, 15615957, 20220731]
  Abstracts  : [6148876, 4020950, 39164524, 2828460, 26501027]
  Texts     : [6148876, 4020950, 39164524, 2828460, 4427392]

Claim 715:
  Titles    : [18949516, 36178047, 18098290, 12821938, 85693958]
  Abstracts  : [36178047, 16267205, 18949516, 5145974, 4457834]
  Texts     : [36178047, 16267205, 18949516, 5145974, 4457834]

Claim 716:
  Titles    : [29107210, 38043606, 23245050, 13883546, 14717500]
  Abstracts  : [70455704, 108886332, 27099731, 25612629, 25690564]
  Texts     : [70455704, 108886332, 27099731, 29107210, 49429882]

Claim 717:
  Titles    : [15615957, 9641846, 37205759, 22406695, 33989422]
  Abstracts  : [36606083, 37592824, 406733, 34105878, 21853444]
  Texts     : [36606083, 34105878, 37592824, 406733, 14145440]

Claim 718:
  Titles    : [7209559, 21472388, 44572913, 11246427, 18537148]
  Abstracts  : [7209559, 44572913, 18537148, 19878070, 11716783]
  Texts     : [7209559, 44572913, 18537148, 19878070, 11716783]

Claim 719:
  Titles    : [7209559, 44572913, 11246427, 108886332, 14103509]
  Abstracts  : [7209559, 19878070, 3613041, 11246427, 44048701]
  Texts     : [7209559, 19878070, 108886332, 3613041, 11246427]

Claim 720:
  Titles    : [2192419, 12966719, 12827098, 18670, 24541180]
  Abstracts  : [12827098, 7521113, 7230315, 24466904, 2192419]
  Texts     : [12827098, 7521113, 7230315, 15081770, 2192419]

Claim 721:
  Titles    : [14658685, 8502193, 16375102, 22696649, 29231620]
  Abstracts  : [39465575, 3495456, 9420732, 23036207, 6148876]
  Texts     : [39465575, 3495456, 16999023, 6148876, 9420732]

Claim 722:
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  Titles     : [13651792, 4388470, 21651116, 28334217, 7039855]
  Abstracts  : [3495456, 23036207, 12240507, 16284655, 39851630]
  Texts      : [3495456, 23036207, 16284655, 12240507, 8771704]


Claim 723:
  Titles     : [25451374, 24318630, 1173667, 2891825, 13338820]
  Abstracts  : [25451374, 14319754, 24273592, 14682243, 12428497]
  Texts      : [25451374, 14319754, 24273592, 14682243, 12428497]


Claim 724:
  Titles     : [14191255, 44265107, 25901598, 22067786, 8724666]
  Abstracts  : [12040627, 14191255, 5389523, 4407318, 36547290]
  Texts      : [12040627, 14191255, 5389523, 36547290, 4407318]


Claim 725:
  Titles     : [20454006, 2488880, 27188320, 24341590, 15559582]
  Abstracts  : [13069283, 24341590, 20454006, 12438901, 17163294]
  Texts      : [13069283, 24341590, 20454006, 12438901, 17163294]


Claim 726:
  Titles     : [5765455, 19922508, 10993232, 24746892, 22696649]
  Abstracts  : [13023410, 1941721, 35543846, 5765455, 4391121]
  Texts      : [13023410, 5765455, 1941721, 35543846, 4391121]


Claim 727:
  Titles     : [46816158, 3893473, 3981729, 1259280, 13878643]
  Abstracts  : [46816158, 3981729, 19099739, 3893473, 19851614]
  Texts      : [46816158, 3981729, 3893473, 19099739, 25830701]


Claim 728:
  Titles     : [37480103, 17124832, 5487448, 13831842, 38551172]
  Abstracts  : [37480103, 13765757, 25973484, 13831842, 16701509]
  Texts      : [37480103, 13765757, 13831842, 25973484, 5487448]


Claim 729:
  Titles     : [20526907, 2787558, 980196, 38551172, 23577867]
  Abstracts  : [52072815, 46437558, 11742219, 71625969, 5939172]
  Texts      : [52072815, 46437558, 71625969, 11742219, 5939172]


Claim 730:
  Titles     : [34227917, 20491205, 43855756, 41380943, 13900610]
  Abstracts  : [13900610, 14843502, 20491205, 34227917, 43855756]
  Texts      : [13900610, 14843502, 20491205, 34227917, 43855756]


Claim 731:
  Titles     : [4406819, 1818578, 27731651, 13135544, 32975424]
  Abstracts  : [4406819, 7481159, 27731651, 22632303, 7145763]
  Texts      : [4406819, 27731651, 7481159, 7145763, 22632303]
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Claim 732:
  Titles     : [28783084, 14692646, 23388442, 11156883, 32742683]
  Abstracts  : [3475317, 34615397, 24707550, 16066726, 21258863]
  Texts      : [34615397, 3475317, 24707550, 9977329, 21258863]

Claim 733:
  Titles     : [3578380, 9769684, 202259, 32421068, 4701662]
  Abstracts  : [3578380, 34481589, 8069939, 3935126, 2492146]
  Texts      : [3578380, 8069939, 34481589, 2492146, 3935126]

Claim 734:
  Titles     : [4687948, 6121668, 22420524, 16398049, 11246427]
  Abstracts  : [4687948, 16812091, 19529370, 3613041, 9555784]
  Texts      : [4687948, 16812091, 19529370, 3613041, 9555784]

Claim 735:
  Titles     : [21239672, 28264919, 2774906, 45200347, 24241932]
  Abstracts  : [21239672, 16511863, 27550580, 28264919, 15925931]
  Texts      : [21239672, 28264919, 27550580, 16511863, 15925931]

Claim 736:
  Titles     : [56893404, 25599283, 9394119, 17656445, 27449472]
  Abstracts  : [56893404, 17656445, 4886637, 41264017, 1974176]
  Texts      : [56893404, 17656445, 4886637, 41264017, 1974176]

Claim 737:
  Titles     : [380526, 43329366, 17625068, 456304, 44672703]
  Abstracts  : [43329366, 380526, 17625068, 14827874, 24323369]
  Texts      : [43329366, 380526, 17625068, 24323369, 22534357]

Claim 738:
  Titles     : [14555750, 28809022, 9732010, 2151983, 13242763]
  Abstracts  : [4896726, 23208167, 11011905, 9732010, 18998807]
  Texts      : [4896726, 23208167, 11011905, 13242763, 9732010]

Claim 739:
  Titles     : [21239672, 28264919, 2774906, 45200347, 24241932]
  Abstracts  : [21239672, 16511863, 27550580, 28264919, 15925931]
  Texts      : [21239672, 28264919, 27550580, 16511863, 15925931]

Claim 740:
  Titles     : [9167230, 52188256, 37156349, 21790313, 33257464]
  Abstracts  : [9167230, 20999249, 1606628, 8298120, 17911973]
  Texts      : [9167230, 20999249, 1606628, 8298120, 52188256]

Claim 741:
  Titles     : [30655442, 520579, 6157371, 4391121, 1044552]
```

```
  Abstracts   : [1373287, 38401028, 19497526, 4391121, 17194716]
  Texts      : [1373287, 38401028, 19497526, 4391121, 6157371]


Claim 742:
  Titles     : [40156901, 31200375, 14060030, 4460880, 17546486]
  Abstracts   : [37673301, 106301, 4932668, 9122283, 3619372]
  Texts      : [106301, 37673301, 4932668, 9122283, 3619372]


Claim 743:
  Titles     : [14060030, 4460880, 2973910, 1905095, 2060137]
  Abstracts   : [37673301, 106301, 4932668, 3619372, 4460880]
  Texts      : [106301, 37673301, 4932668, 3619372, 4460880]


Claim 744:
  Titles     : [7268522, 6993046, 23253955, 37438296, 9909405]
  Abstracts   : [37438296, 18747744, 37673301, 4627816, 43566999]
  Texts      : [37438296, 18747744, 37673301, 4627816, 43566999]


Claim 745:
  Titles     : [23273454, 31933981, 32927401, 17023584, 649951]
  Abstracts   : [17023584, 21498497, 51952430, 23273454, 46135768]
  Texts      : [17023584, 23273454, 31313782, 21498497, 51952430]


Claim 746:
  Titles     : [18231807, 36432234, 23078022, 14362678, 4423401]
  Abstracts   : [37549932, 4387484, 1574014, 25842866, 18231807]
  Texts      : [18231807, 37549932, 4387484, 23078022, 1574014]


Claim 747:
  Titles     : [18231807, 22908536, 418246, 16790253, 23393712]
  Abstracts   : [25842866, 37549932, 16790253, 18231807, 3140772]
  Texts      : [18231807, 25842866, 37549932, 16790253, 3140772]


Claim 748:
  Titles     : [18231807, 23078022, 36432234, 10576136, 34016944]
  Abstracts   : [37549932, 13639330, 1574014, 25842866, 10555591]
  Texts      : [37549932, 13639330, 18231807, 1574014, 25842866]


Claim 749:
  Titles     : [30720103, 52887689, 24055603, 97566194, 3512154]
  Abstracts   : [16461149, 12956194, 11288846, 27138601, 1871230]
  Texts      : [12956194, 16461149, 3610282, 11288846, 32909242]


Claim 750:
  Titles     : [13763195, 12486491, 14874811, 45875990, 275294]
  Abstracts   : [26378103, 45143088, 18924534, 13763195, 935538]
  Texts      : [26378103, 45143088, 13763195, 18924534, 8698857]
```

```
Claim 751:
  Titles     : [40754510, 49208216, 10443642, 35321950, 20388894]
  Abstracts  : [24177706, 49208216, 26751583, 45401535, 10443642]
  Texts      : [24177706, 49208216, 10443642, 45401535, 26751583]

Claim 752:
  Titles     : [4300851, 26083387, 16120395, 7766808, 44724517]
  Abstracts  : [14408200, 35861290, 516867, 21644993, 9704467]
  Texts      : [14408200, 16120395, 26083387, 35861290, 516867]

Claim 753:
  Titles     : [4300851, 26083387, 16120395, 7766808, 32927401]
  Abstracts  : [35861290, 516867, 21644993, 9704467, 12922760]
  Texts      : [16120395, 26083387, 35861290, 516867, 9704467]

Claim 754:
  Titles     : [16284655, 7492250, 31460499, 19511011, 31070360]
  Abstracts  : [16284655, 14192687, 803312, 3952288, 21232018]
  Texts      : [16284655, 14192687, 803312, 3952288, 21232018]

Claim 755:
  Titles     : [8771704, 19912367, 13915464, 20418809, 15955172]
  Abstracts  : [19912367, 20418809, 4326318, 4653837, 6334188]
  Texts      : [19912367, 20418809, 4326318, 8771704, 4653837]

Claim 756:
  Titles     : [19912367, 13915464, 15955172, 1084345, 37438296]
  Abstracts  : [19912367, 4326318, 20418809, 6334188, 15955172]
  Texts      : [19912367, 4326318, 20418809, 15955172, 6334188]

Claim 757:
  Titles     : [13223806, 9021186, 34208005, 52180874, 21150010]
  Abstracts  : [23260700, 10207180, 9197092, 30041895, 40476126]
  Texts      : [23260700, 10207180, 9197092, 30041895, 40476126]

Claim 758:
  Titles     : [19675911, 42291761, 103007, 27768226, 29947146]
  Abstracts  : [24241932, 7111021, 22414304, 20610390, 31363207]
  Texts      : [24241932, 7111021, 20610390, 22414304, 10365749]

Claim 759:
  Titles     : [10039688, 19238, 29381091, 28783084, 14719322]
  Abstracts  : [3475317, 34615397, 24707550, 2947124, 9977329]
  Texts      : [3475317, 34615397, 24707550, 9977329, 2947124]

Claim 760:
  Titles     : [13636631, 2242416, 25726838, 31682248, 9559146]
  Abstracts  : [21382907, 8702697, 41877386, 18275697, 120626]
```

```
  Texts    : [21382907, 8702697, 29509926, 41877386, 343052]


Claim 761:
  Titles   : [13636631, 25726838, 14938990, 25832301, 22210434]
  Abstracts : [8702697, 17844478, 18275697, 120626, 29509926]
  Texts    : [17844478, 8702697, 29509926, 21382907, 13329980]


Claim 762:
  Titles   : [1649738, 24237492, 12428137, 11238951, 23304931]
  Abstracts : [1649738, 6559701, 15081770, 30226988, 1153655]
  Texts    : [1649738, 6559701, 15081770, 11238951, 1153655]


Claim 763:
  Titles   : [5567005, 15578265, 13940200, 36642096, 42873134]
  Abstracts : [266641, 11899391, 25571386, 9822397, 8842332]
  Texts    : [266641, 11899391, 25571386, 9822397, 13448422]


Claim 764:
  Titles   : [27569370, 1944452, 25806385, 6790197, 22922353]
  Abstracts : [15482274, 84580585, 52874170, 13497630, 6847208]
  Texts    : [15482274, 84580585, 52874170, 13497630, 6847208]


Claim 765:
  Titles   : [27569370, 1944452, 25806385, 6790197, 22922353]
  Abstracts : [15482274, 52874170, 4325398, 13497630, 21297708]
  Texts    : [15482274, 52874170, 4325398, 24906548, 13497630]


Claim 766:
  Titles   : [5273056, 8759633, 8577229, 9875570, 14332945]
  Abstracts : [4037034, 7137057, 18037805, 5273056, 13790144]
  Texts    : [4037034, 7137057, 18037805, 5273056, 13790144]


Claim 767:
  Titles   : [21891856, 4389394, 3590806, 3591070, 21033230]
  Abstracts : [28249680, 46617075, 42489926, 37204802, 12762485]
  Texts    : [28249680, 46617075, 42489926, 37204802, 31902335]


Claim 768:
  Titles   : [40710501, 5406411, 46127781, 9486930, 23397658]
  Abstracts : [9505402, 9929089, 26973393, 18682109, 34066665]
  Texts    : [9505402, 9929089, 26973393, 18682109, 34066665]


Claim 769:
  Titles   : [3835423, 24879055, 2248870, 19005293, 12966719]
  Abstracts : [19005293, 10648422, 8300657, 219475, 26068103]
  Texts    : [19005293, 3835423, 8300657, 10648422, 24879055]


Claim 770:
```

```
Titles    : [3835423, 24879055, 2248870, 19005293, 12966719]
Abstracts : [19005293, 10648422, 8300657, 3835423, 26068103]
Texts     : [19005293, 3835423, 8300657, 24879055, 10648422]


Claim 771:
Titles    : [5377642, 19047331, 8764879, 26688294, 42782688]
Abstracts : [5377642, 5752492, 1454773, 9178310, 3870062]
Texts     : [5377642, 5752492, 1454773, 9178310, 3870062]


Claim 772:
Titles    : [19047331, 8764879, 26688294, 42782688, 23863551]
Abstracts : [5377642, 3870062, 10648422, 17844478, 9178310]
Texts     : [5377642, 3870062, 19047331, 10648422, 17844478]


Claim 773:
Titles    : [36111909, 7925817, 16090672, 2481032, 31347396]
Abstracts : [28369117, 21598000, 35231675, 36111909, 7925817]
Texts     : [28369117, 36111909, 21598000, 35231675, 7925817]


Claim 774:
Titles    : [2097256, 8665891, 18816720, 23203102, 16098747]
Abstracts : [2097256, 18816720, 17454301, 25069745, 27527854]
Texts     : [2097256, 18816720, 17454301, 25069745, 27527854]


Claim 775:
Titles    : [9588931, 3173489, 32742683, 26121646, 28249680]
Abstracts : [5256564, 24185667, 28937856, 9588931, 2030623]
Texts     : [5256564, 24185667, 28937856, 9588931, 2030623]


Claim 776:
Titles    : [21956124, 37628989, 21297708, 708425, 8300657]
Abstracts : [13764090, 12966719, 24190159, 708425, 11415809]
Texts     : [13764090, 12966719, 708425, 24190159, 11415809]


Claim 777:
Titles    : [11614737, 24019260, 22482820, 34369306, 10617916]
Abstracts : [11614737, 5114940, 24019260, 5551138, 1759213]
Texts     : [11614737, 5114940, 24019260, 5551138, 1759213]


Claim 778:
Titles    : [15488881, 45143088, 18041692, 26297042, 8629328]
Abstracts : [38587347, 15488881, 15058155, 28644298, 3580005]
Texts     : [38587347, 15488881, 15058155, 28644298, 3580005]


Claim 779:
Titles    : [1122279, 935034, 21902400, 28647122, 10145528]
Abstracts : [1122279, 8290953, 23513718, 79447, 25175997]
Texts     : [1122279, 8290953, 23513718, 79447, 25175997]
```

```
Claim 780:
  Titles    : [16736883, 4406819, 11411060, 52874170, 8533245]
  Abstracts  : [4406819, 27731651, 34735369, 38675228, 16736883]
  Texts     : [4406819, 27731651, 34735369, 38675228, 16736883]

Claim 781:
  Titles    : [26611834, 9555784, 5487448, 34544514, 13312471]
  Abstracts  : [2425364, 17450673, 23267371, 21380348, 13312471]
  Texts     : [2425364, 13312471, 23267371, 17450673, 19799455]

Claim 782:
  Titles    : [16256507, 3758260, 21564598, 275294, 22843838]
  Abstracts  : [16256507, 23267371, 8856690, 13312471, 9555784]
  Texts     : [16256507, 23267371, 8856690, 9555784, 13312471]

Claim 783:
  Titles    : [21003930, 28738741, 3619931, 42387637, 26058927]
  Abstracts  : [21003930, 53779698, 2248870, 28738741, 42387637]
  Texts     : [21003930, 53779698, 28738741, 2248870, 42387637]

Claim 784:
  Titles    : [21003930, 28738741, 3619931, 42387637, 26058927]
  Abstracts  : [21003930, 53779698, 2248870, 28738741, 42387637]
  Texts     : [21003930, 53779698, 28738741, 2248870, 42387637]

Claim 785:
  Titles    : [21993510, 21623140, 25599283, 3572885, 4810810]
  Abstracts  : [21623140, 23245050, 21993510, 36558211, 16322674]
  Texts     : [21623140, 23245050, 21993510, 36558211, 16322674]

Claim 786:
  Titles    : [21993510, 21623140, 3572885, 11837657, 36860856]
  Abstracts  : [21623140, 21993510, 2659805, 16322674, 23245050]
  Texts     : [21623140, 21993510, 16322674, 2659805, 23245050]

Claim 787:
  Titles    : [19408393, 23639838, 31616203, 15669393, 9629682]
  Abstracts  : [19408393, 23639838, 22509015, 31616203, 9629682]
  Texts     : [19408393, 23639838, 31616203, 22509015, 9629682]

Claim 788:
  Titles    : [11630388, 17124832, 22890091, 12206390, 12794099]
  Abstracts  : [2488880, 20526907, 29253460, 33835579, 15984735]
  Texts     : [2488880, 20526907, 29253460, 33835579, 15984735]

Claim 789:
  Titles    : [5487448, 2015126, 13765757, 26611834, 38784540]
```

```
  Abstracts   : [37480103, 5487448, 17450673, 16322674, 38784540]
  Texts     : [37480103, 5487448, 17450673, 38784540, 16322674]


Claim 790:
  Titles    : [10675756, 40096222, 1387654, 1265945, 23356816]
  Abstracts   : [13481880, 42782688, 20310709, 1022115, 1265945]
  Texts     : [42782688, 13481880, 20310709, 1022115, 1265945]


Claim 791:
  Titles    : [9483851, 3831884, 10365787, 4455466, 20672596]
  Abstracts   : [3831884, 4138659, 9483851, 1344498, 5256564]
  Texts     : [3831884, 4138659, 9483851, 1344498, 5256564]


Claim 792:
  Titles    : [2919030, 16280642, 22767022, 2825380, 14308244]
  Abstracts   : [306006, 9283422, 12265561, 994800, 40383969]
  Texts     : [306006, 9283422, 994800, 12265561, 17539488]


Claim 793:
  Titles    : [6896063, 4653837, 7451018, 9559146, 4162857]
  Abstracts   : [15521377, 25419778, 6896063, 9669099, 9559146]
  Texts     : [15521377, 9669099, 6896063, 25419778, 9559146]


Claim 794:
  Titles    : [2316374, 19165076, 22997657, 13552682, 35448676]
  Abstracts   : [2890952, 34498325, 13552682, 30261663, 16242975]
  Texts     : [2890952, 34498325, 13552682, 30261663, 16242975]


Claim 795:
  Titles    : [41710132, 2158516, 6766459, 18084826, 145383432]
  Abstracts   : [6766459, 22800314, 129199129, 34121231, 4319174]
  Texts     : [6766459, 22800314, 129199129, 34121231, 4319174]


Claim 796:
  Titles    : [435529, 13290521, 21909315, 32556431, 9159495]
  Abstracts   : [6766459, 86602746, 2619579, 5253987, 8006440]
  Texts     : [6766459, 2619579, 5253987, 8006440, 9159495]


Claim 797:
  Titles    : [20130904, 23267371, 42330403, 12561083, 20186814]
  Abstracts   : [5253987, 6913227, 16086778, 4740447, 12440953]
  Texts     : [5253987, 6913227, 16086778, 4305576, 4740447]


Claim 798:
  Titles    : [11666252, 33569870, 26702468, 14874811, 10641162]
  Abstracts   : [12582729, 32556431, 2452989, 15590539, 12652963]
  Texts     : [12582729, 32556431, 15590539, 2452989, 2000038]
```

```
Claim 799:
  Titles     : [5492542, 26008462, 5586392, 24790460, 14626540]
  Abstracts  : [36831892, 22309946, 7506409, 7711685, 19343151]
  Texts      : [5492542, 36831892, 22309946, 7711685, 7506409]

Claim 800:
  Titles     : [6422576, 19343151, 4452659, 4418269, 8979167]
  Abstracts  : [19343151, 18218379, 7506409, 928281, 23746313]
  Texts      : [19343151, 18218379, 7506409, 928281, 23746313]

Claim 801:
  Titles     : [368506, 935034, 9977329, 39381118, 14706752]
  Abstracts  : [368506, 14706752, 3847200, 207972, 25251625]
  Texts      : [368506, 14706752, 3847200, 207972, 25251625]

Claim 802:
  Titles     : [14021596, 39059143, 5185871, 27054878, 28894097]
  Abstracts  : [5185871, 3878434, 26314743, 34208005, 20746604]
  Texts      : [5185871, 3878434, 26314743, 34208005, 20746604]

Claim 803:
  Titles     : [4658268, 11887584, 20725212, 29877890, 40900242]
  Abstracts  : [29877890, 37164306, 13907427, 20781656, 30184745]
  Texts      : [29877890, 37164306, 13907427, 30184745, 20781656]

Claim 804:
  Titles     : [14615911, 33370, 23777820, 6944800, 24282306]
  Abstracts  : [38355793, 33370, 3419802, 33638477, 19644821]
  Texts      : [38355793, 33370, 33638477, 3419802, 19644821]

Claim 805:
  Titles     : [14615911, 33370, 23777820, 6944800, 24282306]
  Abstracts  : [38355793, 33370, 3419802, 22180793, 33638477]
  Texts      : [38355793, 33370, 33638477, 3419802, 22180793]

Claim 806:
  Titles     : [5849439, 464511, 435529, 7681810, 9769310]
  Abstracts  : [10504681, 20402596, 19950357, 38675228, 4350400]
  Texts      : [10504681, 20402596, 19950357, 38675228, 4350400]

Claim 807:
  Titles     : [2617858, 4857085, 10577574, 27768226, 11419230]
  Abstracts  : [2617858, 1744752, 3441524, 14362678, 10577574]
  Texts      : [2617858, 1744752, 3441524, 14362678, 10577574]

Claim 808:
  Titles     : [7549811, 45199834, 16090672, 38127792, 7912]
  Abstracts  : [7549811, 35231675, 24555417, 29863668, 21598000]
```

```
Texts    : [29863668, 7549811, 24555417, 35231675, 21598000]
```

**3.3 Affichage des performances (4 points)** Affichez les résultats des performances BM25 pour les configurations Top1, Top3 et Top5 avec "*title*", "*asbtract*" et "*text*".

[56]:
```
results_titles_BM25_df = prepare_results_df(df_claims, ['claim', 'evidence',␣
 ↪'claim_length', 'num_cited_doc', 'claims_preprocessed'], 'cited_doc_ids')
results_abstracts_BM25_df = prepare_results_df(df_claims, ['claim', 'evidence',␣
 ↪'claim_length', 'num_cited_doc', 'claims_preprocessed'], 'cited_doc_ids')
results_texts_BM25_df = prepare_results_df(df_claims, ['claim', 'evidence',␣
 ↪'claim_length', 'num_cited_doc', 'claims_preprocessed'], 'cited_doc_ids')

results_titles_BM25_df = fill_results(results_titles_BM25,␣
 ↪results_titles_BM25_df)
results_abstracts_BM25_df = fill_results(results_abstracts_BM25,␣
 ↪results_abstracts_BM25_df)
results_texts_BM25_df = fill_results(results_texts_BM25, results_texts_BM25_df)
```

[57]:
```
# Calcul des précisions
precisions_titles_BM25 = evaluate_precision(results_titles_BM25_df)
precisions_abstracts_BM25 = evaluate_precision(results_abstracts_BM25_df)
precisions_texts_BM25 = evaluate_precision(results_texts_BM25_df)

# Tableau des résultats
table_data = [
    ["Titles", *precisions_titles_BM25],
    ["Abstracts", *precisions_abstracts_BM25],
    ["Texts", *precisions_texts_BM25]
]

# Affichage
print(tabulate(table_data, headers=['Precision par BM25', 'Précision@1',␣
 ↪'Précision@3', 'Précision@5'], tablefmt='grid'))
```

```
Précision @1: 0.3239
Précision @3: 0.1475
Précision @5: 0.0994
Précision @1: 0.5538
Précision @3: 0.2344
Précision @5: 0.1567
Précision @1: 0.5674
Précision @3: 0.2394
Précision @5: 0.1582
+----------------------+--------------+--------------+--------------+
| Precision par BM25   |  Précision@1 |  Précision@3 |  Précision@5 |
+======================+==============+==============+==============+
| Titles               |     0.323857 |     0.147507 |     0.099382 |
```

```
+--------------------+-------------+-------------+-------------+
| Abstracts          |     0.55377 |    0.234446 |    0.156737 |
+--------------------+-------------+-------------+-------------+
| Texts              |    0.567367 |     0.23939 |     0.15822 |
+--------------------+-------------+-------------+-------------+
```

**3.4 Graphique (4 points)**  Dans un même graphique, affichez les performances pour les deux modèles (TF-IDF et BM25) dans la recherche des documents (text, title et abstract) pour les affirmations.

[58]:
```python
# Définition des valeurs de N
N_values = [1, 3, 5]

# Création de la figure
plt.figure()

# Courbes de précision pour TF-IDF
plt.plot(N_values, precision_titles, marker='o', label='TF-IDF - Titles')
plt.plot(N_values, precision_abstracts, marker='o', label='TF-IDF - Abstracts')
plt.plot(N_values, precision_texts, marker='o', label='TF-IDF - Texts')

# Courbes de précision pour BM25
plt.plot(N_values, precisions_titles_BM25, marker='x', label='BM25 - Titles',
   ↪linestyle='--')
plt.plot(N_values, precisions_abstracts_BM25, marker='x', label='BM25 -
   ↪Abstracts', linestyle='--')
plt.plot(N_values, precisions_texts_BM25, marker='x', label='BM25 - Texts',
   ↪linestyle='--')

# Personnalisation du graphique
plt.xlabel('Top-N')
plt.ylabel('Précision')
plt.title('Comparaison des performances entre TF-IDF et BM25')
plt.legend()
plt.grid()

# Affichage du graphique
plt.show()
```
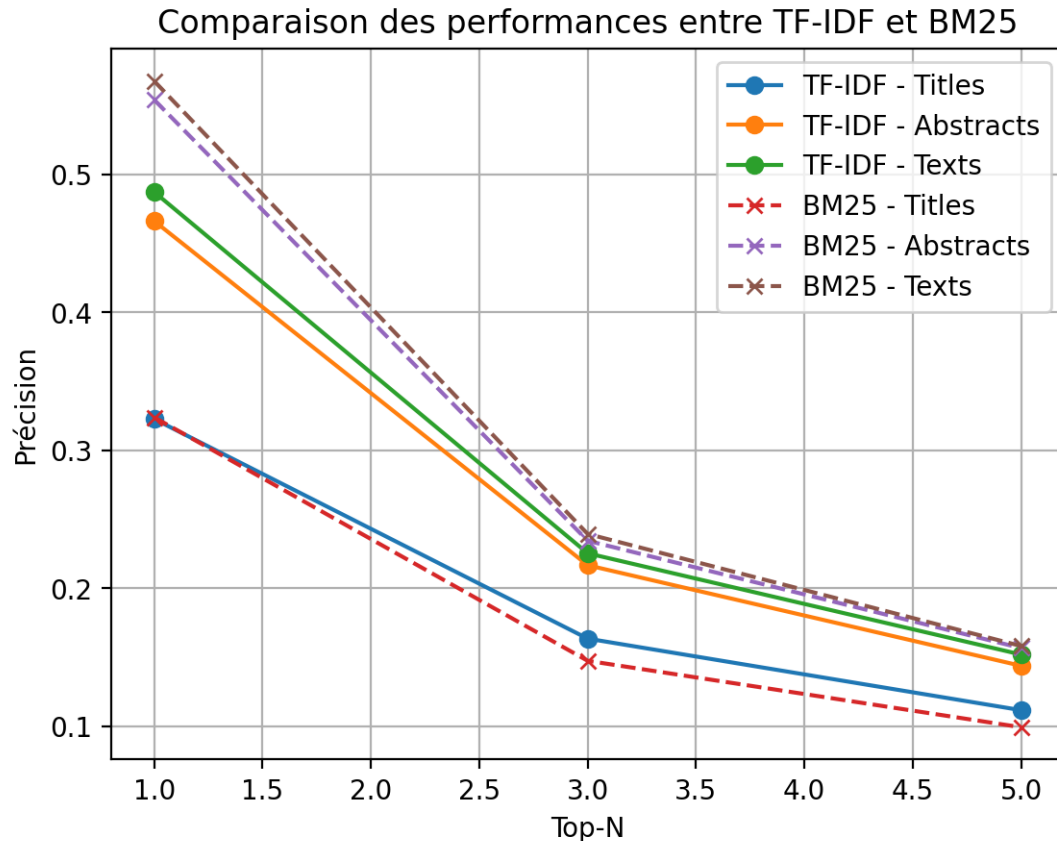
Comparaison des performances entre TF-IDF et BM25

**3.5 Observation (4 points)** Par rapport à vos résultats avec TF-IDF, observez-vous une amélioration ou une détérioration des performances, qu'est ce qui explique cela ? (Donnez au moins trois justifications)

**On observe une amélioration des performances pour BM25 comparé à TF-IDF pour plusieurs raisons :**

1. BM25 permet des ajustements paramétriques qui optimisent les performances selon les caractéristiques des documents, alors que TF-IDF est plus rigide.
2. La fonction de pondération plus complexe de BM25, qui prend en compte la saturation des termes explique en partie sa supériorité.
3. BM25 corrige mieux l'impact des documents longs ou courts, tandis que TF-IDF ne tient pas compte de la longueur du document. Cela désavantage TF-IDF lorsqu'il s'agit de longs textes.

## 0.4 Livrables

Vous devez remettre votre notebook sur Moodle et Gradescope en ipynb et pdf. Pour Gradescope vous devez associer les numéros de questions avec vos réponses dans le pdf grâce à l'outil que fournit Gradescope.

## 0.5 Évaluation

Votre TP sera évalué selon les critères suivants : 1. Exécution correcte du code et obtention des sorties attendues 2. Réponses correctes aux questions d'analyse 3. Qualité du code (noms significatifs, structure, performance, gestion d'exception, etc.) 4. Commentaires clairs et informatifs