In [1]:

```
import os
import json
import gc
import pickle

import numpy as np
import pandas as pd
from tqdm import tqdm_notebook as tqdm
import tensorflow as tf
from tensorflow.keras.models import Model
from tensorflow.keras.layers import *
from tensorflow.keras.preprocessing import text, sequence
from tensorflow.keras.utils import plot_model
import fasttext
```

In [2]:

```
# https://www.kaggle.com/opanichev/tf2-0-qa-binary-classification-baseline
def build_train(train_path, n_rows=200000):
    with open(train_path) as f:
        processed_rows = []

        for i in tqdm(range(n_rows)):
            line = f.readline()
            if not line:
                break

            line = json.loads(line)

            text = line['document_text'].split(' ')
            question = line['question_text']
            annotations = line['annotations'][0]
            start_long = annotations['long_answer']['start_token']
            if start_long == -1:
                continue
            end_long = annotations['long_answer']['end_token']

            if len(annotations['short_answers'])>0:
                start_short = annotations['short_answers'][0]['start_token']
                end_short = annotations['short_answers'][0]['end_token']
                short = " ".join(text[start_short:end_short])
            else:
                short = "NONE"
            try:
                processed_rows.append({
                        'text': " ".join(text[start_long:end_long]),
                        'question': question,
                        'short_answer':"startseq " + short + " endseq",
                        'annotation_id': annotations['annotation_id']
                })
            except:
                continue

        train = pd.DataFrame(processed_rows)

        return train
```

In [3]:

```
def build_test(test_path, submission_path):
    test = pd.read_json(test_path, orient='records', lines=True, dtype={'example_id':np.
dtype('object')})
    submission = pd.read_csv(submission_path)

    short = '_short'
    processed_rows = []
```

```
    for i in tqdm(range(len(submission))):
        if submission.iloc[i]['example_id'].endswith(short):
            id = submission.iloc[i]['example_id'][:-6]
            token = submission.iloc[i]['PredictionString']

            if isinstance(token, str): # https://www.geeksforgeeks.org/python-check-if-a
-variable-is-string/
                # sample dataframe corresponding to the id
                sample_df = test[test['example_id'] == id]
                # Text of the sample df
                text = sample_df.iloc[0]['document_text'].split()
                # Corresponding Question
                question = sample_df.iloc[0]['question_text']

                # start: the token before ":", end: the token after ":"
                index = token.index(':')
                start = int(token[:index])
                end = int(token[index+1:])

                # text corresponds to the long answer
                text = " ".join(text[start:end])
                processed_rows.append({
                        'text': text,
                        'question': question,
                        'annotation_id': id
                })

            else:
                # No long answer.
                token = np.nan

    return pd.DataFrame(processed_rows)
```

In [4]:

```
train_path = '/kaggle/input/tensorflow2-question-answering/simplified-nq-train.jsonl'
test_path = '/kaggle/input/tensorflow2-question-answering/simplified-nq-test.jsonl'
submission_path = "../input/baseline-lstm/submission.csv"
```

In [5]:

```
train = build_train(train_path)
test= build_test(test_path, submission_path)
```

```
/opt/conda/lib/python3.7/site-packages/ipykernel_launcher.py:6: TqdmDeprecationWarning: T
his function will be removed in tqdm==5.0.0
Please use `tqdm.notebook.tqdm` instead of `tqdm.tqdm_notebook`
```

```
/opt/conda/lib/python3.7/site-packages/ipykernel_launcher.py:7: TqdmDeprecationWarning: T
his function will be removed in tqdm==5.0.0
Please use `tqdm.notebook.tqdm` instead of `tqdm.tqdm_notebook`
  import sys
```

In [6]:

```
train.head()
```

Out[6]:

	text	question	short_answer	annotation_id
0	<P> A common example of permission marketing i...	which is the most common use of opt-in e-mail ...	startseq a newsletter sent to an advertising f...	593165450220027640
1	<P> Tracy McConnell , better known as `` The M...	how i.met your mother who is the mother	startseq Tracy McConnell endseq	12034874153783787365
2	<P> The process of fertilization involves a sp...	what type of fertilisation takes place in humans	startseq NONE endseq	10527123009892725162

	text	question	short_answer	annotation_id
3	<P> Active quarterback Tom Brady holds the rec...	who had the most wins in the nfl	startseq Tom Brady endseq	14634796365152556576
4	<P> Pom Klementieff (born 3 May 1986) is a F...	who played mantis guardians of the galaxy 2	startseq Pom Klementieff endseq	12644762478285625867

In [7]:

```
test.head()
```

Out[7]:

	text	question	annotation_id
0	<P> Since 1997 , US courts have divided price ...	association of producers that control supply a...	-1011141123527297803
1	<P> The title You 've Come a Long Way , Baby w...	norman cook you've come a long way	-1028916936938579349
2	<P> Raghava and Nandini move into another hous...	kanchana 2 film kanchana 2 film kanchana 2 fil...	-1055197305756217938
3	<Tr> <Th> Location </Th> <Td> Tilak Marg , New...	who appoint the judge of supreme court and hig...	-1074129516932871805
4	<P> Brooke has an end of the summer party on t...	who released the time capsule in one tree hill	-1114334749483663139

In [8]:

```
from sklearn.model_selection import train_test_split
X_train, X_test, Y_train, Y_test = train_test_split(train.drop(['short_answer'], 1), tra
in['short_answer'])
del train
```

In [9]:

```
def pad_sequence(t, padding_var = 20):
    t = sequence.pad_sequences(t, maxlen=padding_var, padding='post')
    return t

def build_train_X(X_train, X_test, test):
    print("="*100)
    print("Tokenizing the sequences...")

    tokenizer = text.Tokenizer(lower=True, num_words=80000)
    tokenizer.fit_on_texts(X_train['text'].append(X_train['question'], ignore_index=True
).to_frame(name = 'text')['text'])

    print("Done")
    print("="*100)
    print()
    print("Starting Text to sequences process...")
    train_text = tokenizer.texts_to_sequences(X_train.text.values)
    val_text = tokenizer.texts_to_sequences(X_train.question.values)
    train_questions = tokenizer.texts_to_sequences(X_test.text.values)
    val_questions = tokenizer.texts_to_sequences(X_test.question.values)
    test_text = tokenizer.texts_to_sequences(test.text.values)
    test_questions = tokenizer.texts_to_sequences(test.question.values)

    print("Done")
    print("="*100)
    print()

    print("Padding Each Sequences...")
    train_text  = pad_sequence(train_text, 400)
    val_text = pad_sequence(val_text, 400)

    train_questions = pad_sequence(train_questions, 20)
    val_questions = pad_sequence(val_questions, 20)

    test_text = pad_sequence(test_text, 400)
    test_questions = pad_sequence(test_questions, 20)
    print("Done")
```

```
    return train_text, val_text, train_questions, val_questions, test_text, test_question
s, tokenizer

def build_y(Y_train, Y_test):
    tokenizer = text.Tokenizer(lower=True)

    tokenizer.fit_on_texts(Y_train)
    print("Done")
    print("="*100)
    print()
    print("Starting Text to sequences process...")
    train_short_answer = tokenizer.texts_to_sequences(Y_train.values)
    val_short_answer = tokenizer.texts_to_sequences(Y_test.values)
    print("Done")
    print("="*100)
    print()

    print("Padding Each Sequences...")

    train_short_answer = pad_sequence(train_short_answer, 25)
    val_short_answer = pad_sequence(val_short_answer, 25)

    print("Done")
    return train_short_answer, val_short_answer, tokenizer
```

In [10]:

```
train_text, val_text, train_questions, val_questions, test_text, test_questions, tokenize
r_X = build_train_X(X_train, X_test, test)
```

```
==========================================================================================
==========
Tokenizing the sequences...
Done
==========================================================================================
==========

Starting Text to sequences process...
Done
==========================================================================================
==========

Padding Each Sequences...
Done
```

In [11]:

```
train_short_answer, val_short_answer,tokenizer_Y = build_y(Y_train, Y_test)
```

```
Done
==========================================================================================
==========

Starting Text to sequences process...
Done
==========================================================================================
==========

Padding Each Sequences...
Done
```

In [12]:

```
del X_train, X_test, Y_train, Y_test
```

In [13]:

```
# saving
with open('tokenizer_X.pickle', 'wb') as handle:
    pickle.dump(tokenizer_X, handle, protocol=pickle.HIGHEST_PROTOCOL)
# saving
```

```
with open('tokenizer_Y.pickle', 'wb') as handle:
    pickle.dump(tokenizer_Y, handle, protocol=pickle.HIGHEST_PROTOCOL)
```

In [14]:

```
import fasttext
def build_embedding_matrix_X(tokenizer, path):
    embedding_matrix = np.zeros((tokenizer.num_words + 1, 300))
    ft_model = fasttext.load_model(path)

    for word, i in tokenizer.word_index.items():
        if i >= tokenizer.num_words - 1:
            break
        embedding_matrix[i] = ft_model.get_word_vector(word)

    return embedding_matrix
path = '/kaggle/input/fasttextsubword/crawl-300d-2M-subword.bin'

def build_embedding_matrix_Y(tokenizer, path):
    embedding_matrix = np.zeros((len(tokenizer.word_counts) + 1, 300))
    ft_model = fasttext.load_model(path)

    for word, i in tokenizer.word_index.items():
        if i >= len(tokenizer.word_counts) - 1:
            break
        embedding_matrix[i] = ft_model.get_word_vector(word)

    return embedding_matrix

embedding_matrix_enc = build_embedding_matrix_X(tokenizer_X, path)
embedding_matrix_dec = build_embedding_matrix_Y(tokenizer_Y, path)
```

```
Warning : `load_model` does not return WordVectorModel or SupervisedModel any more, but a `FastText` object which is very similar.
Warning : `load_model` does not return WordVectorModel or SupervisedModel any more, but a `FastText` object which is very similar.
```

In [15]:

```
embedding_matrix_enc.shape, embedding_matrix_dec.shape
```

Out[15]:

```
((80001, 300), (30400, 300))
```

In [16]:

```
vocab_size_enc = len(tokenizer_X.word_counts)
vocab_size_dec = len(tokenizer_Y.word_counts)+1
```

In [17]:

```
def build_model(latent_dim=256):

    embedding_enc = Embedding(*embedding_matrix_enc.shape, weights=[embedding_matrix_enc
], trainable=False, mask_zero=True)
    embedding_dec = Embedding(*embedding_matrix_dec.shape, weights=[embedding_matrix_dec
], trainable=False, mask_zero=True)

    # Encoder question
    encoder_inputs_q = Input(shape=(None,), name="encoder_input_q")
    enc_emb_q = embedding_enc(encoder_inputs_q)
    _, state_h_q, state_c_q = LSTM(latent_dim, return_state=True)(enc_emb_q)

    # Encoder text
    encoder_inputs_t = Input(shape=(None,), name="encoder_input_t")
    enc_emb_t = embedding_enc(encoder_inputs_t)
    _, state_h_t, state_c_t = LSTM(latent_dim, return_state=True)(enc_emb_t)

    encoder_states = [concatenate([state_h_q, state_h_t]), concatenate([state_c_q, state
_c_t])]
```

```
    # decoder Model
    decoder_inputs = Input(shape=(None,), name="decoder_input")
    dec_emb_layer = embedding_dec(decoder_inputs)
    decoder_outputs, _, _ = LSTM(2*latent_dim, return_sequences=True, return_state=True)
(dec_emb_layer,initial_state=encoder_states)
    decoder_outputs = Dense(vocab_size_dec, activation='softmax')(decoder_outputs)

    model = Model([encoder_inputs_q, encoder_inputs_t, decoder_inputs], decoder_outputs)

    # Encode the input sequence to get the "thought vectors"
    encoder_model = Model([encoder_inputs_q, encoder_inputs_t], encoder_states)

    # Decoder setup
    # Below tensors will hold the states of the previous time step
    decoder_state_input_h = Input(shape=(2*latent_dim,))
    decoder_state_input_c = Input(shape=(2*latent_dim,))
    decoder_states_inputs = [decoder_state_input_h, decoder_state_input_c]

    dec_emb2= embedding_dec(decoder_inputs) # Get the embeddings of the decoder sequence

    # To predict the next word in the sequence, set the initial states to the states from
the previous time step
    decoder_outputs2, state_h2, state_c2 = LSTM(2*latent_dim, return_sequences=True, ret
urn_state=True)(dec_emb2, initial_state=decoder_states_inputs)
    decoder_states2 = [state_h2, state_c2]
    decoder_outputs2 = Dense(vocab_size_dec, activation='softmax')(decoder_outputs2) # A
dense softmax layer to generate prob dist. over the target vocabulary

    # Final decoder model
    decoder_model = Model([decoder_inputs] + decoder_states_inputs, [decoder_outputs2] +
decoder_states2)

    return model, encoder_model, decoder_model
```

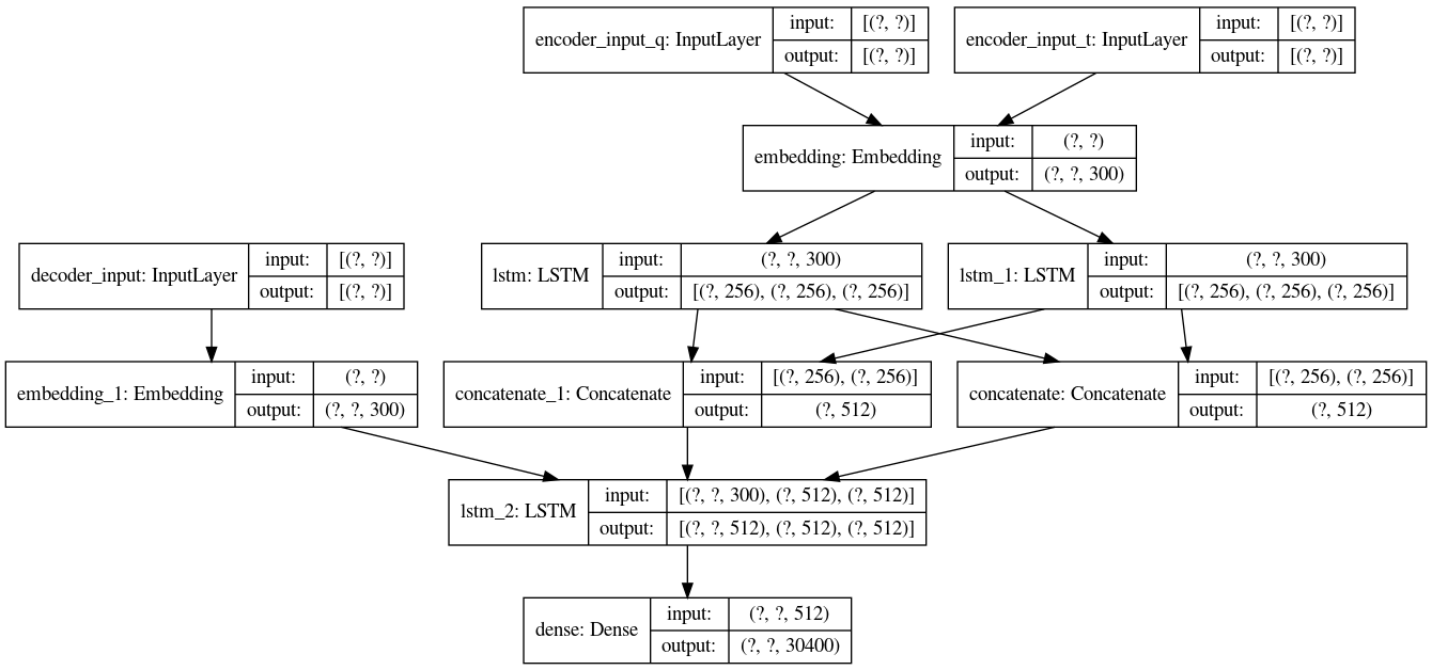
In [18]:

```
model, encoder_model, decoder_model = build_model()
```

In [19]:

```
plot_model(
    model, to_file='model.png', show_shapes=True, show_layer_names=True,
    rankdir='TB', expand_nested=False, dpi=96
)
```

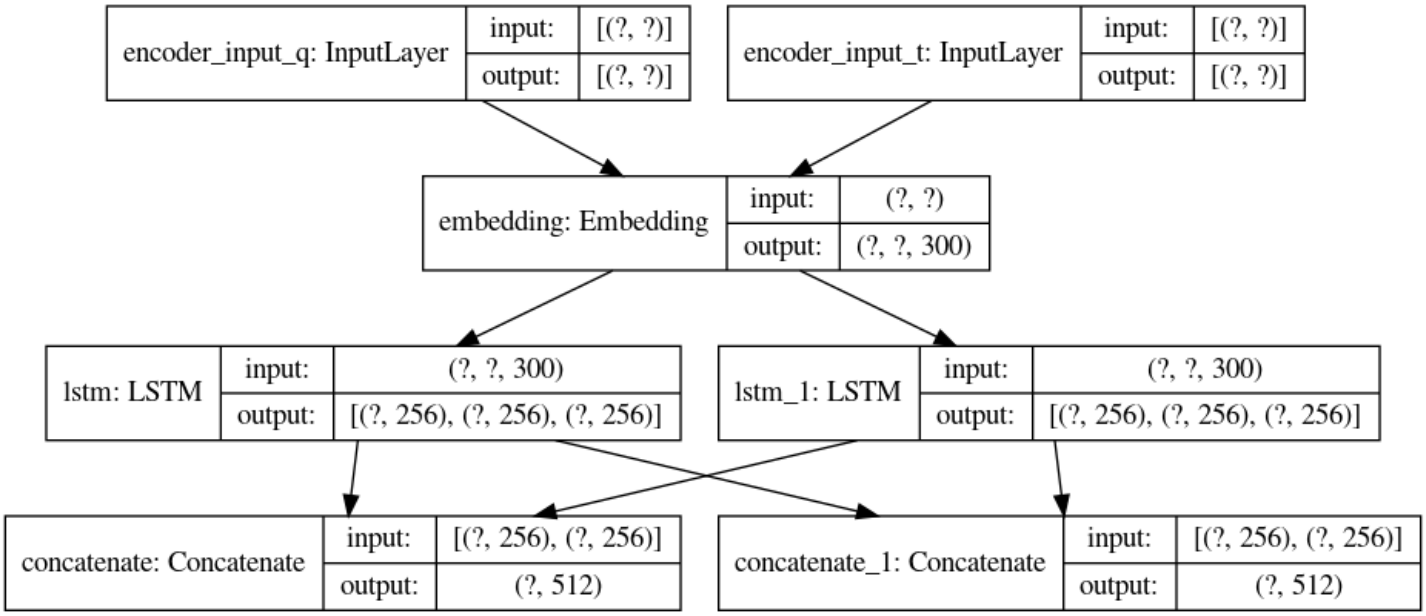
Out[19]:



In [20]:

```
plot_model(
    encoder_model, to_file='encoder_model.png', show_shapes=True, show_layer_names=True,
    rankdir='TB', expand_nested=False, dpi=96
)
```

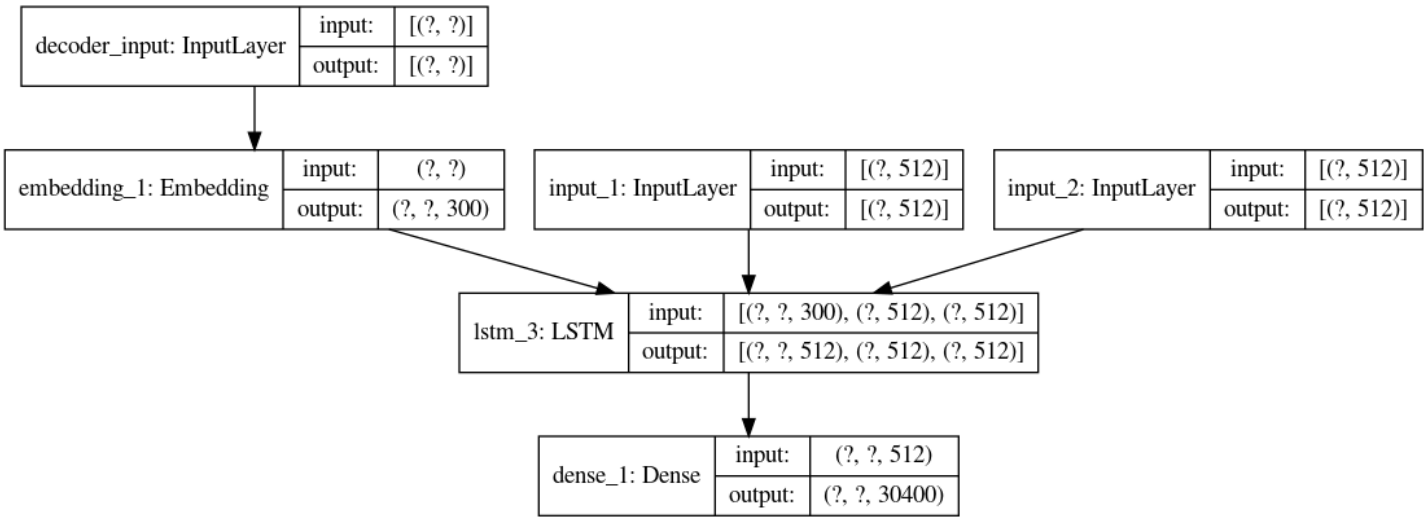
Out[20]:



In [21]:

```
plot_model(
    decoder_model, to_file='decoder_model.png', show_shapes=True, show_layer_names=True,
    rankdir='TB', expand_nested=False, dpi=96
)
```

Out[21]:



In [22]:

```
def generate_batch(train_question, train_text, train_short_answer, batch_size = 128):
    while True:
        for j in range(0, len(train_question), batch_size):
            encoder_input_q = np.array(train_question[j:j+batch_size])
            encoder_input_t = np.array(train_text[j:j+batch_size])
            decoder_input_data = np.array(train_short_answer[j:j+batch_size])

            decoder_target_data = np.zeros((encoder_input_q.shape[0], 25, vocab_size_dec
),dtype='float32')
            for i, target_text in enumerate(train_short_answer[j:j+batch_size]):
                for t, index in enumerate(target_text):
                    if t>0:
                        # decoder target sequence (one hot encoded)
                        # does not include the START_ token
```

```
                        decoder_target_data[i, t - 1, index] = 1.

            yield([encoder_input_q, encoder_input_t, decoder_input_data], decoder_target
_data)
```

In [23]:

```
model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['acc'])
```

In [24]:

```
train_samples = len(train_questions)
val_samples = len(val_questions)
batch_size = 128
epochs = 50
```

In [25]:

```
model.fit_generator(generator = generate_batch(train_questions, train_text, train_short_a
nswer, batch_size = batch_size),
                    steps_per_epoch = train_samples//batch_size,
                    epochs=epochs,
                    validation_data = generate_batch(val_questions, val_text, val_short_
answer, batch_size = batch_size),
                    validation_steps = val_samples//batch_size)
```

```
Epoch 1/50
193/193 [==============================] - 240s 1s/step - loss: 1.1359 - acc: 0.1492 - va
l_loss: 0.9225 - val_acc: 0.0701
Epoch 2/50
193/193 [==============================] - 238s 1s/step - loss: 0.9150 - acc: 0.0916 - va
l_loss: 0.8748 - val_acc: 0.0867
Epoch 3/50
193/193 [==============================] - 237s 1s/step - loss: 0.8710 - acc: 0.0941 - va
l_loss: 0.8715 - val_acc: 0.0885
Epoch 4/50
193/193 [==============================] - 237s 1s/step - loss: 0.8441 - acc: 0.0947 - va
l_loss: 0.8698 - val_acc: 0.0896
Epoch 5/50
193/193 [==============================] - 237s 1s/step - loss: 0.8205 - acc: 0.0951 - va
l_loss: 0.8635 - val_acc: 0.0908
Epoch 6/50
193/193 [==============================] - 238s 1s/step - loss: 0.7973 - acc: 0.0953 - va
l_loss: 0.8642 - val_acc: 0.0913
Epoch 7/50
193/193 [==============================] - 238s 1s/step - loss: 0.7753 - acc: 0.0955 - va
l_loss: 0.8632 - val_acc: 0.0916
Epoch 8/50
193/193 [==============================] - 238s 1s/step - loss: 0.7554 - acc: 0.0958 - va
l_loss: 0.8600 - val_acc: 0.0917
Epoch 9/50
193/193 [==============================] - 238s 1s/step - loss: 0.7515 - acc: 0.0960 - va
l_loss: 0.8659 - val_acc: 0.0920
Epoch 10/50
193/193 [==============================] - 239s 1s/step - loss: 0.7436 - acc: 0.0962 - va
l_loss: 0.8705 - val_acc: 0.0916
Epoch 11/50
193/193 [==============================] - 238s 1s/step - loss: 0.7242 - acc: 0.0965 - va
l_loss: 0.8597 - val_acc: 0.0925
Epoch 12/50
193/193 [==============================] - 238s 1s/step - loss: 0.7076 - acc: 0.0967 - va
l_loss: 0.8600 - val_acc: 0.0933
Epoch 13/50
193/193 [==============================] - 238s 1s/step - loss: 0.6893 - acc: 0.0970 - va
l_loss: 0.8657 - val_acc: 0.0933
Epoch 14/50
193/193 [==============================] - 239s 1s/step - loss: 0.6726 - acc: 0.0974 - va
l_loss: 0.8751 - val_acc: 0.0930
Epoch 15/50
193/193 [==============================] - 238s 1s/step - loss: 0.6606 - acc: 0.0978 - va
l_loss: 0.8830 - val_acc: 0.0932
Epoch 16/50
```

```
Epoch 16/50
193/193 [==============================] - 238s 1s/step - loss: 0.6522 - acc: 0.0983 - va
l_loss: 0.8771 - val_acc: 0.0933
Epoch 17/50
193/193 [==============================] - 239s 1s/step - loss: 0.6370 - acc: 0.0990 - va
l_loss: 0.8887 - val_acc: 0.0930
Epoch 18/50
193/193 [==============================] - 238s 1s/step - loss: 0.6379 - acc: 0.0995 - va
l_loss: 0.8760 - val_acc: 0.0936
Epoch 19/50
193/193 [==============================] - 239s 1s/step - loss: 0.6207 - acc: 0.1005 - va
l_loss: 0.8821 - val_acc: 0.0935
Epoch 20/50
193/193 [==============================] - 239s 1s/step - loss: 0.6115 - acc: 0.1012 - va
l_loss: 0.8949 - val_acc: 0.0933
Epoch 21/50
193/193 [==============================] - 239s 1s/step - loss: 0.5974 - acc: 0.1024 - va
l_loss: 0.8938 - val_acc: 0.0933
Epoch 22/50
193/193 [==============================] - 239s 1s/step - loss: 0.5827 - acc: 0.1036 - va
l_loss: 0.9031 - val_acc: 0.0933
Epoch 23/50
193/193 [==============================] - 238s 1s/step - loss: 0.5926 - acc: 0.1041 - va
l_loss: 0.8918 - val_acc: 0.0936
Epoch 24/50
193/193 [==============================] - 238s 1s/step - loss: 0.5807 - acc: 0.1052 - va
l_loss: 0.8904 - val_acc: 0.0937
Epoch 25/50
193/193 [==============================] - 239s 1s/step - loss: 0.5666 - acc: 0.1065 - va
l_loss: 0.8926 - val_acc: 0.0938
Epoch 26/50
193/193 [==============================] - 238s 1s/step - loss: 0.5584 - acc: 0.1077 - va
l_loss: 0.8976 - val_acc: 0.0938
Epoch 27/50
193/193 [==============================] - 239s 1s/step - loss: 0.5519 - acc: 0.1085 - va
l_loss: 0.8984 - val_acc: 0.0938
Epoch 28/50
193/193 [==============================] - 238s 1s/step - loss: 0.5405 - acc: 0.1097 - va
l_loss: 0.9071 - val_acc: 0.0937
Epoch 29/50
193/193 [==============================] - 239s 1s/step - loss: 0.5296 - acc: 0.1108 - va
l_loss: 0.9016 - val_acc: 0.0938
Epoch 30/50
193/193 [==============================] - 239s 1s/step - loss: 0.5216 - acc: 0.1117 - va
l_loss: 0.9108 - val_acc: 0.0936
Epoch 31/50
193/193 [==============================] - 239s 1s/step - loss: 0.5086 - acc: 0.1131 - va
l_loss: 0.9138 - val_acc: 0.0936
Epoch 32/50
193/193 [==============================] - 238s 1s/step - loss: 0.4972 - acc: 0.1144 - va
l_loss: 0.9184 - val_acc: 0.0934
Epoch 33/50
193/193 [==============================] - 239s 1s/step - loss: 0.4897 - acc: 0.1155 - va
l_loss: 0.9255 - val_acc: 0.0934
Epoch 34/50
193/193 [==============================] - 239s 1s/step - loss: 0.4796 - acc: 0.1166 - va
l_loss: 0.9312 - val_acc: 0.0933
Epoch 35/50
193/193 [==============================] - 239s 1s/step - loss: 0.4718 - acc: 0.1176 - va
l_loss: 0.9283 - val_acc: 0.0935
Epoch 36/50
193/193 [==============================] - 238s 1s/step - loss: 0.4635 - acc: 0.1186 - va
l_loss: 0.9368 - val_acc: 0.0933
Epoch 37/50
193/193 [==============================] - 239s 1s/step - loss: 0.4567 - acc: 0.1196 - va
l_loss: 0.9429 - val_acc: 0.0931
Epoch 38/50
193/193 [==============================] - 239s 1s/step - loss: 0.4505 - acc: 0.1205 - va
l_loss: 0.9458 - val_acc: 0.0930
Epoch 39/50
193/193 [==============================] - 240s 1s/step - loss: 0.4405 - acc: 0.1220 - va
l_loss: 0.9567 - val_acc: 0.0930
Epoch 40/50
```

```
193/193 [==============================] - 239s 1s/step - loss: 0.4340 - acc: 0.1230 - va
l_loss: 0.9648 - val_acc: 0.0925
Epoch 41/50
193/193 [==============================] - 239s 1s/step - loss: 0.4261 - acc: 0.1241 - va
l_loss: 0.9639 - val_acc: 0.0926
Epoch 42/50
193/193 [==============================] - 240s 1s/step - loss: 0.4187 - acc: 0.1251 - va
l_loss: 0.9764 - val_acc: 0.0921
Epoch 43/50
193/193 [==============================] - 239s 1s/step - loss: 0.4114 - acc: 0.1263 - va
l_loss: 0.9740 - val_acc: 0.0924
Epoch 44/50
193/193 [==============================] - 239s 1s/step - loss: 0.4039 - acc: 0.1273 - va
l_loss: 0.9729 - val_acc: 0.0925
Epoch 45/50
193/193 [==============================] - 239s 1s/step - loss: 0.3982 - acc: 0.1283 - va
l_loss: 0.9790 - val_acc: 0.0922
Epoch 46/50
193/193 [==============================] - 238s 1s/step - loss: 0.3916 - acc: 0.1294 - va
l_loss: 0.9830 - val_acc: 0.0921
Epoch 47/50
193/193 [==============================] - 239s 1s/step - loss: 0.3845 - acc: 0.1306 - va
l_loss: 0.9902 - val_acc: 0.0918
Epoch 48/50
193/193 [==============================] - 240s 1s/step - loss: 0.3767 - acc: 0.1315 - va
l_loss: 0.9903 - val_acc: 0.0921
Epoch 49/50
193/193 [==============================] - 239s 1s/step - loss: 0.3776 - acc: 0.1313 - va
l_loss: 0.9899 - val_acc: 0.0923
Epoch 50/50
193/193 [==============================] - 239s 1s/step - loss: 0.3681 - acc: 0.1330 - va
l_loss: 0.9998 - val_acc: 0.0921
```

Out[25]:

```
<tensorflow.python.keras.callbacks.History at 0x7fd85164b850>
```

In [26]:

```
model.save_weights('model_baseline_short.h5')
```

In [27]:

```
model.load_weights('model_baseline_short.h5')
```

In [37]:

```
def decode_sequence(text, question):
    # Encode the input as state vectors.
    input_seq = [np.array(question).reshape(1, 20),np.array(text.reshape(1, 400)) ]
    states_value = encoder_model.predict(input_seq)
    # Generate empty target sequence of length 1.
    target_seq = np.zeros((1,1))
    # Populate the first character of target sequence with the start character.
    target_seq[0, 0] = tokenizer_Y.word_index['startseq']

    stop_condition = False
    decoded_sentence = ''
    while not stop_condition:
        output_tokens, h, c = decoder_model.predict([target_seq] + states_value)

        # Sample a token
        sampled_token_index = np.argmax(output_tokens[0, -1, :])
        sampled_char = tokenizer_Y.index_word[sampled_token_index]
        decoded_sentence += ' '+sampled_char
        # Exit condition: either hit max length
        # or find stop character.
        if (sampled_char == 'endseq' or
           len(decoded_sentence.split()) > 25):
            stop_condition = True
```

```
        # Update the target sequence (of length 1).
        target_seq = np.zeros((1,1))
        target_seq[0, 0] = sampled_token_index

        # Update states
        states_value = [h, c]

    return decoded_sentence
```

In [59]:

```
print("annotation_id: {}".format(test.iloc[0]['annotation_id']))
print("Text: {}...".format(test.iloc[0]['text'][:200]))
print("Question: {}".format(test.iloc[0]['question']))
print()
print("Predicted Answer: {}".format( decode_sequence(test_text[0], test_questions[0]) ))
```

```
annotation_id: -1011141123527297803
Text: <P> Since 1997 , US courts have divided price fixing into two categories : vertical
and horizontal maximum price fixing . Vertical price fixing includes a manufacturer 's at
tempt to control the price ...
Question: association of producers that control supply and prices

Predicted Answer: Since 1997 , US courts have divided price fixing
```

In [68]:

```
print("annotation_id: {}".format(test.iloc[1]['annotation_id']))
print("Text: {}...".format(test.iloc[1]['text'][:200]))
print("Question: {}".format(test.iloc[1]['question']))
print()
print("Predicted Answer: {}".format( decode_sequence(test_text[1], test_questions[1]) ))
```

```
annotation_id: -1028916936938579349
Text: <P> The title You 've Come a Long Way , Baby was derived from a marketing slogan fo
r Virginia Slims cigarettes . Conceived by Red Design , the album 's primary cover art fe
atures an obese young man dr...
Question: norman cook you've come a long way

Predicted Answer: slogan for Virginia Slims cigarettes . Conceived by Red Design , the al
bum 's primary cover art features an obese young
```

In [73]:

```
print("annotation_id: {}".format(test.iloc[3]['annotation_id']))
print("Text: {}...".format(test.iloc[3]['text'][:200]))
print("Question: {}".format(test.iloc[3]['question']))
print()
print("Predicted Answer: {}".format( decode_sequence(test_text[3], test_questions[3]) ))
```

```
annotation_id: -1074129516932871805
Text: <Tr> <Th> Location </Th> <Td> Tilak Marg , New Delhi , Delhi </Td> </Tr>...
Question: who appoint the judge of supreme court and high court

Predicted Answer: Tilak Marg
```

In [77]:

```
print("annotation_id: {}".format(test.iloc[4]['annotation_id']))
print("Text: {}...".format(test.iloc[4]['text'][:200]))
print("Question: {}".format(test.iloc[4]['question']))
print()
print("Predicted Answer: {}".format( decode_sequence(test_text[4], test_questions[4]) ))
```

```
annotation_id: -1114334749483663139
Text: <P> Brooke has an end of the summer party on the beach . Nathan is home from basket
ball camp . Lucas deals with Brooke 's rules for non-exclusive dating . Brooke ends up ha
ving a ball with many guys w...
Question: who released the time capsule in one tree hill

Predicted Answer: NONE
```

In [86]:

```
print("annotation_id: {}".format(test.iloc[5]['annotation_id']))
print("Text: {}...".format(test.iloc[5]['text'][:200]))
print("Question: {}".format(test.iloc[5]['question']))
print()
print("Predicted Answer: {}".format( decode_sequence(test_text[5], test_questions[5]) ))
```

```
annotation_id: -1152268629614456016
Text: <P> Server Core does not include the . NET Framework , Internet Explorer , Windows
PowerShell or many other features not related to core server features . A Server Core mac
hine can be configured for s...
Question: what feature introduced with windows server 2008 provides only a limited gui

Predicted Answer: NET Framework , Internet Explorer , Windows PowerShell or many other fe
atures
```