In [12]:
```
import numpy as np
from word2vec import *
from nltk.tokenize import sent_tokenize, word_tokenize
import warnings
import nltk
import gensim

# todo:1
class word_obj:
    cosine_sim=-100
    word=None

    def __init__(self, cosine_sim=-100, word='None'):
        self.cosine_sim = cosine_sim
        self.word = word

    def __str__(self):
        return self.word

    def __repr__(self):
        return self.word
```

In [13]:
```
def read_glove_vecs(glove_file):
    with open(glove_file, 'r') as f:
        words = set()
        word_to_vec_map = {}
        for line in f:
            line = line.strip().split()
            curr_word = line[0]
            words.add(curr_word)
            word_to_vec_map[curr_word] = np.array(line[1:], dtype=np.float6
    return word_to_vec_map
```

In [14]:
```
def cosine_similarity(u, v):
    distance = 0.0
    # Compute the dot product between u and v
    dot = np.dot(u,v)
    # Compute the L2 norm of u
    norm_u = np.sqrt(np.sum(u * u))
    # Compute the L2 norm of v
    norm_v = np.sqrt(np.sum(v * v))
    # Compute the cosine similarity defined by formula (1) (≈1 line)
    cosine_similarity = dot / (norm_u * norm_v)
    return cosine_similarity
```

In [15]:
```
def complete_analogy(word_a, word_b, word_c, word_to_vec_map):
    words = word_to_vec_map.keys()
    best_3_words_obj = [word_obj(), word_obj(), word_obj()] # Initialize be

    # convert words to lower case
    word_a, word_b, word_c = word_a.lower(), word_b.lower(), word_c.lower()

    # Get the word embeddings v_a, v_b, v_c and estimated v_d
    e_a, e_b, e_c = word_to_vec_map[word_a], word_to_vec_map[word_b], word_
    e_d_ = e_c + e_b - e_a

    # loop over the whole word vector set
    for w in words:
        # to avoid best_word being one of the input words, pass on them.
        if w in [word_a, word_b, word_c] :
            continue

        # Compute cosine similarity between the vector (e_b - e_a) and the
        cosine_sim = cosine_similarity(e_d_, word_to_vec_map[w])

        # If the cosine_sim is more than the minimum in best_3, add it to b
        if cosine_sim > best_3_words_obj[2].cosine_sim:
            best_3_words_obj.append(word_obj(cosine_sim, w))
            best_3_words_obj = sorted(best_3_words_obj, key=lambda x: x.cos

    return best_3_words_obj
```

In [16]:
```
def analogy_accuracy_rate(filepath):
    file = open(filepath, "r")
    lines = file.readlines()
    total = 0
    best_1 = 0
    best_3 = 0
    for line in lines:
        words = word_tokenize(line)
        if len(words) == 4:
            total += 1
            best_3_words_obj = complete_analogy(words[0], words[1], words[2
            best_3_words = [o.word for o in best_3_words_obj]
            print('given true a,b,c,d -> ', words)
            print('best_3 match for d item -> ', best_3_words)
            if best_3_words[0] == words[3]:
                best_1 += 1
            if words[3] in best_3_words:
                best_3 += 1
    print("best_1 accuracy: ", best_1/total)
    print("best_3 accuracy: ", best_3/total)
```

In [17]:
```
word_to_vec_map = read_glove_vecs('/Users/nehakardam/Documents/UWclasses /E
```

In [23]:
```
len(word_to_vec_map)
```

Out[23]:
```
400000
```

In [7]:
```
analogy_accuracy_rate("/Users/nehakardam/Documents/UWclasses /EE517 NLP/Lab
analogy_accuracy_rate("/Users/nehakardam/Documents/UWclasses /EE517 NLP/Lab
analogy_accuracy_rate("/Users/nehakardam/Documents/UWclasses /EE517 NLP/Lab
analogy_accuracy_rate("/Users/nehakardam/Documents/UWclasses /EE517 NLP/Lab
```

```
given true a,b,c,d ->  ['her', 'his', 'sisters', 'brothers']
best_3 match for d item ->  ['sons', 'brothers', 'fathers']
given true a,b,c,d ->  ['grandmother', 'grandfather', 'mom', 'dad']
best_3 match for d item ->  ['dad', 'guy', 'uncle']
given true a,b,c,d ->  ['bride', 'groom', 'mother', 'father']
best_3 match for d item ->  ['wife', 'friend', 'daughter']
given true a,b,c,d ->  ['aunt', 'uncle', 'grandma', 'grandpa']
best_3 match for d item ->  ['grandpa', 'dad', 'yogi']
given true a,b,c,d ->  ['niece', 'nephew', 'grandaughter', 'grandson']
best_3 match for d item ->  ['grandnephew', 'karatzaferis', 'forefather']
given true a,b,c,d ->  ['queen', 'king', 'she', 'he']
best_3 match for d item ->  ['he', 'him', 'when']
given true a,b,c,d ->  ['grandma', 'grandpa', 'her', 'his']
best_3 match for d item ->  ['his', 'she', 'him']
given true a,b,c,d ->  ['woman', 'man', 'wife', 'husband']
best_3 match for d item ->  ['friend', 'brother', 'son']
given true a,b,c,d ->  ['daughter', 'son', 'woman', 'man']
best_3 match for d item ->  ['man', 'boy', 'old']
given true a,b,c,d ->  ['stepsister', 'stepbrother', 'daughters', 'sons']
```

Designed task

In [8]:
```
analogy_accuracy_rate("/Users/nehakardam/Documents/UWclasses /EE517 NLP/Lab
```

```
given true a,b,c,d ->  ['angry', 'angrier', 'cheap', 'cheaper']
best_3 match for d item ->  ['costlier', 'pricier', 'affordably']
given true a,b,c,d ->  ['clever', 'cleverer', 'coarse', 'coarser']
best_3 match for d item ->  ['coarser', 'undyed', 'lucani']
given true a,b,c,d ->  ['costly', 'costlier', 'cute', 'cuter']
best_3 match for d item ->  ['adorable', 'perky', 'cuter']
given true a,b,c,d ->  ['dense', 'denser', 'dumb', 'dumber']
best_3 match for d item ->  ['dumber', 'conceited', 'egotistical']
given true a,b,c,d ->  ['fierce', 'fiercer', 'handy', 'handier']
best_3 match for d item ->  ['affordably', 'embraceable', 'smarttoaster']
given true a,b,c,d ->  ['happy', 'happier', 'hardy', 'hardier']
best_3 match for d item ->  ['amies', 'fownes', 'farre']
given true a,b,c,d ->  ['harsh', 'harsher', 'healthy', 'healthier']
best_3 match for d item ->  ['healthier', 'quicker', 'balanced']
given true a,b,c,d ->  ['hot', 'hotter', 'huge', 'huger']
best_3 match for d item ->  ['dwarfed', 'enormous', 'magnified']
given true a,b,c,d ->  ['hungry', 'hungrier', 'lazy', 'lazier']
best_3 match for d item ->  ['dreadfully', 'turny', 'agreeably']
given true a,b,c,d ->  ['lengthy', 'lengthier', 'lucky', 'luckier']
best_3 match for d item ->  ['hungrier', 'prettier', 'vanous']
given true a,b,c,d ->  ['mad', 'madder', 'merry', 'merrier']
best_3 match for d item ->  ['bukka', 'hollyhocks', 'delphiniums']
given true a,b,c,d ->  ['mild', 'milder', 'moist', 'moister']
best_3 match for d item ->  ['drier', 'rainforests', 'savanna']
given true a,b,c,d ->  ['nasty', 'nastier', 'neat', 'neater']
best_3 match for d item ->  ['neater', 'sillier', 'crisper']
given true a,b,c,d ->  ['nice', 'nicer', 'noisy', 'noisier']
best_3 match for d item ->  ['noisier', 'unhappier', 'crashworthy']
given true a,b,c,d ->  ['proud', 'prouder', 'pure', 'purer']
best_3 match for d item ->  ['purer', 'vanillin', 'cruder']
given true a,b,c,d ->  ['risky', 'riskier', 'rocky', 'rockier']
best_3 match for d item ->  ['craggy', 'cliffs', 'bottoms']
given true a,b,c,d ->  ['rude', 'ruder', 'sad', 'sadder']
best_3 match for d item ->  ['huber', 'cadafalch', 'škofja']
given true a,b,c,d ->  ['scary', 'scarier', 'sexy', 'sexier']
best_3 match for d item ->  ['sexier', 'cuter', 'prettier']
given true a,b,c,d ->  ['sticky', 'stickier', 'strict', 'stricter']
best_3 match for d item ->  ['strictures', 'restrictive', 'strictest']
given true a,b,c,d ->  ['strong', 'stronger', 'subtle', 'subtler']
best_3 match for d item ->  ['subtly', 'subtler', 'nuances']
given true a,b,c,d ->  ['sunny', 'sunnier', 'tasty', 'tastier']
best_3 match for d item ->  ['tastier', 'appetizing', 'morsels']
given true a,b,c,d ->  ['tiny', 'tinier', 'tricky', 'trickier']
best_3 match for d item ->  ['unserious', 'trickier', 'dificult']
given true a,b,c,d ->  ['ugly', 'uglier', 'vague', 'vaguer']
best_3 match for d item ->  ['comprehensible', 'couched', 'vaguer']
given true a,b,c,d ->  ['vast', 'vaster', 'weak', 'weaker']
best_3 match for d item ->  ['morose', 'sassier', 'revealingly']
given true a,b,c,d ->  ['wealthy', 'wealthier', 'weird', 'weirder']
best_3 match for d item ->  ['oftentimes', 'thankfully', 'hokey']
best_1 accuracy:  0.32
best_3 accuracy:  0.48
```

In [17]:
```
analogy_accuracy_rate("/Users/nehakardam/Documents/UWclasses /EE517 NLP/Lab
```

```
given true a,b,c,d ->  ['calm', 'calmly', 'complete', 'completely']
best_3 match for d item ->  ['nailed', 'inserted', 'completed']
given true a,b,c,d ->  ['apparent', 'apparently', 'slow', 'slowly']
best_3 match for d item ->  ['fast', 'quickly', 'getting']
given true a,b,c,d ->  ['amazing', 'amazingly', 'free', 'freely']
best_3 match for d item ->  ['allowing', 'restricted', 'allow']
given true a,b,c,d ->  ['cheerful', 'cheerfully', 'occasional', 'occasion
ally']
best_3 match for d item ->  ['frequent', 'jokes', 'endless']
given true a,b,c,d ->  ['most', 'mostly', 'fortunate', 'fortunately']
best_3 match for d item ->  ['terrified', 'unlucky', 'frightened']
given true a,b,c,d ->  ['obvious', 'obviously', 'serious', 'seriously']
best_3 match for d item ->  ['concerned', 'seriously', 'worse']
given true a,b,c,d ->  ['possible', 'possibly', 'quiet', 'quietly']
best_3 match for d item ->  ['sleepy', 'deserted', 'tranquil']
given true a,b,c,d ->  ['professional', 'professionally', 'immediate', 'i
mmediately']
best_3 match for d item ->  ['swiftly', 'respond', 'materialized']
given true a,b,c,d ->  ['quick', 'quickly', 'rapid', 'rapidly']
best_3 match for d item ->  ['rapidly', 'gradually', 'continuously']
given true a,b,c,d ->  ['rapid', 'rapidly', 'sudden', 'suddenly']
best_3 match for d item ->  ['suddenly', 'disappear', 'slowly']
given true a,b,c,d ->  ['rare', 'rarely', 'furious', 'furiously']
best_3 match for d item ->  ['frustrated', 'hesitated', 'angry']
given true a,b,c,d ->  ['reluctant', 'reluctantly', 'happy', 'happily']
best_3 match for d item ->  ['glad', "'m", 'i']
given true a,b,c,d ->  ['safe', 'safely', 'precise', 'precisely']
best_3 match for d item ->  ['measurements', 'accurately', 'trajectorie
s']
given true a,b,c,d ->  ['serious', 'seriously', 'rare', 'rarely']
best_3 match for d item ->  ['critically', 'alive', 'found']
given true a,b,c,d ->  ['sudden', 'suddenly', 'complete', 'completely']
best_3 match for d item ->  ['entire', 'fully', 'then']
given true a,b,c,d ->  ['swift', 'swiftly', 'precise', 'precisely']
best_3 match for d item ->  ['precisely', 'correctly', 'accurately']
given true a,b,c,d ->  ['typical', 'typically', 'reluctant', 'reluctantl
y']
best_3 match for d item ->  ['unwilling', 'persuade', 'convince']
given true a,b,c,d ->  ['usual', 'usually', 'calm', 'calmly']
best_3 match for d item ->  ['remain', 'very', 'leave']
given true a,b,c,d ->  ['swift', 'swiftly', 'cheerful', 'cheerfully']
best_3 match for d item ->  ['behaving', 'perpetually', 'behaved']
given true a,b,c,d ->  ['amazing', 'amazingly', 'reluctant', 'reluctantl
y']
best_3 match for d item ->  ['hesitant', 'unwilling', 'wary']
best_1 accuracy:  0.15
best_3 accuracy:  0.2
```

In [19]:
```
analogy_accuracy_rate("/Users/nehakardam/Documents/UWclasses /EE517 NLP/Lab
```

```
given true a,b,c,d ->  ['acceptable', 'unacceptable', 'competitive', 'unc
ompetitive']
best_3 match for d item ->  ['competition', 'unfair', 'aggressive']
given true a,b,c,d ->  ['aware', 'unaware', 'certain', 'uncertain']
best_3 match for d item ->  ['any', 'presumably', 'specific']
given true a,b,c,d ->  ['reasonable', 'unreasonable', 'productive', 'unpr
oductive']
best_3 match for d item ->  ['inefficient', 'exploitative', 'exploitive']
given true a,b,c,d ->  ['certain', 'uncertain', 'consistent', 'inconsiste
nt']
best_3 match for d item ->  ['optimistic', 'pessimistic', 'remarkably']
given true a,b,c,d ->  ['clear', 'unclear', 'logical', 'illogical']
best_3 match for d item ->  ['logically', 'simplest', 'causal']
given true a,b,c,d ->  ['competitive', 'uncompetitive', 'informative', 'u
ninformative']
best_3 match for d item ->  ['well-done', 'unobjectionable', 'well-resear
ched']
given true a,b,c,d ->  ['possibly', 'impossibly', 'efficient', 'inefficie
nt']
best_3 match for d item ->  ['aerodynamically', 'uncluttered', 'nimble']
given true a,b,c,d ->  ['convincing', 'unconvincing', 'productive', 'unpr
oductive']
best_3 match for d item ->  ['unproductive', 'conflictual', 'unspectacula
r']
given true a,b,c,d ->  ['informative', 'uninformative', 'productive', 'un
productive']
best_3 match for d item ->  ['unharvested', 'unproductive', 'disadvantage
ous']
given true a,b,c,d ->  ['decided', 'undecided', 'responsible', 'irrespons
ible']
best_3 match for d item ->  ['unaligned', 'ideologically', 'respondents']
given true a,b,c,d ->  ['efficient', 'inefficient', 'certain', 'uncertai
n']
best_3 match for d item ->  ['instances', 'dealt', 'exceptions']
given true a,b,c,d ->  ['fortunate', 'unfortunate', 'rational', 'irration
al']
best_3 match for d item ->  ['relation', 'context', 'logical']
given true a,b,c,d ->  ['honest', 'dishonest', 'aware', 'unaware']
best_3 match for d item ->  ['overreacting', 'condoned', 'deterred']
given true a,b,c,d ->  ['impressive', 'unimpressive', 'acceptable', 'unac
ceptable']
best_3 match for d item ->  ['disadvantageous', 'preferable', 'tenable']
given true a,b,c,d ->  ['informative', 'uninformative', 'certain', 'uncer
tain']
best_3 match for d item ->  ['induce', 'tolerate', 'residual']
given true a,b,c,d ->  ['informed', 'uninformed', 'certain', 'uncertain']
best_3 match for d item ->  ['conversely', 'propensity', 'deviations']
given true a,b,c,d ->  ['known', 'unknown', 'impressive', 'unimpressive']
best_3 match for d item ->  ['astonishing', 'surprising', 'remarkable']
given true a,b,c,d ->  ['logical', 'illogical', 'ethical', 'unethical']
best_3 match for d item ->  ['flouting', 'immorality', 'disregarding']
given true a,b,c,d ->  ['possible', 'impossible', 'productive', 'unproduc
tive']
best_3 match for d item ->  ['self-sufficient', 'tremendously', 'immensel
y']
```

```
given true a,b,c,d ->  ['rational', 'irrational', 'tasteful', 'distastefu
l']
best_3 match for d item ->  ['tacky', 'kitschy', 'imitations']
given true a,b,c,d ->  ['sure', 'unsure', 'known', 'unknown']
best_3 match for d item ->  ['originated', 'extinct', 'unknown']
given true a,b,c,d ->  ['Decided', 'undecided', 'logical', 'illogical']
best_3 match for d item ->  ['plausible', 'cogent', '5-to-1']
best_1 accuracy:  0.045454545454545456
best_3 accuracy:  0.13636363636363635
```

In [16]:
```
analogy_accuracy_rate("/Users/nehakardam/Documents/UWclasses /EE517 NLP/Lab
```

```
given true a,b,c,d ->  ['adds', 'added', 'agrees', 'agreed']
best_3 match for d item ->  ['agreed', 'decided', 'intends']
given true a,b,c,d ->  ['allows', 'allowed', 'announces', 'announced']
best_3 match for d item ->  ['announcing', 'announced', 'last']
given true a,b,c,d ->  ['appears', 'appeared', 'applies', 'applied']
best_3 match for d item ->  ['rules', 'laws', 'apply']
given true a,b,c,d ->  ['appoints', 'appointed', 'asks', 'asked']
best_3 match for d item ->  ['he', 'father', 'she']
given true a,b,c,d ->  ['becomes', 'became', 'believes', 'believed']
best_3 match for d item ->  ['recently', 'joined', 'had']
given true a,b,c,d ->  ['considers', 'considered', 'consists', 'consiste
d']
best_3 match for d item ->  ['consisting', 'consist', 'consisted']
given true a,b,c,d ->  ['contains', 'contained', 'continues', 'continue
d']
best_3 match for d item ->  ['continuing', 'continue', 'continued']
given true a,b,c,d ->  ['creates', 'created', 'decides', 'decided']
best_3 match for d item ->  ['decided', 'persuaded', 'chose']
given true a,b,c,d ->  ['describes', 'described', 'develops', 'develope
d']
best_3 match for d item ->  ['develop', 'developed', 'focused']
given true a,b,c,d ->  ['establishes', 'established', 'expects', 'expecte
d']
best_3 match for d item ->  ['year', 'expected', 'recently']
given true a,b,c,d ->  ['fails', 'failed', 'follows', 'followed']
best_3 match for d item ->  ['followed', 'following', 'early']
given true a,b,c,d ->  ['happens', 'happened', 'hears', 'heard']
best_3 match for d item ->  ['heard', 'screams', 'hear']
given true a,b,c,d ->  ['includes', 'included', 'intends', 'intended']
best_3 match for d item ->  ['persuaded', 'intention', 'hoped']
given true a,b,c,d ->  ['introduces', 'introduced', 'involves', 'involve
d']
best_3 match for d item ->  ['used', 'similar', 'which']
given true a,b,c,d ->  ['locates', 'located', 'loses', 'lost']
best_3 match for d item ->  ['is', 'now', 'portion']
given true a,b,c,d ->  ['manages', 'managed', 'marries', 'married']
best_3 match for d item ->  ['marrying', 'cousin', 'father']
given true a,b,c,d ->  ['occurs', 'occurred', 'operates', 'operated']
best_3 match for d item ->  ['offices', 'headquarters', 'depot']
given true a,b,c,d ->  ['performs', 'performed', 'proposes', 'proposed']
best_3 match for d item ->  ['proposed', 'plan', 'proposal']
given true a,b,c,d ->  ['provides', 'provided', 'publishes', 'published']
best_3 match for d item ->  ['publications', 'journals', 'published']
given true a,b,c,d ->  ['receives', 'received', 'refers', 'referred']
best_3 match for d item ->  ['referred', '—', 'latter']
given true a,b,c,d ->  ['relates', 'related', 'remains', 'remained']
best_3 match for d item ->  ['already', 'remain', 'been']
given true a,b,c,d ->  ['replaces', 'replaced', 'represents', 'represente
d']
best_3 match for d item ->  ['which', 'the', 'of']
given true a,b,c,d ->  ['requires', 'required', 'seems', 'seemed']
best_3 match for d item ->  ['probably', 'indeed', 'though']
given true a,b,c,d ->  ['sends', 'sent', 'spends', 'spent']
best_3 match for d item ->  ['spent', 'years', 'months']
given true a,b,c,d ->  ['suggests', 'suggested', 'tells', 'told']
```

```
best_3 match for d item ->  ['asks', 'asked', 'friend']
best_1 accuracy:  0.28
best_3 accuracy:  0.52
```

In [11]:
```
analogy_accuracy_rate("/Users/nehakardam/Documents/UWclasses /EE517 NLP/Lab
```

```
given true a,b,c,d ->  ['aristotle', 'greek', 'balzac', 'french']
best_3 match for d item ->  ['spanish', 'french', 'portuguese']
given true a,b,c,d ->  ['beethoven', 'german', 'caesar', 'roman']
best_3 match for d item ->  ['mercenaries', 'forces', 'foreign']
given true a,b,c,d ->  ['confucius', 'chinese', 'copernicus', 'polish']
best_3 match for d item ->  ['russian', 'foreign', 'currency']
given true a,b,c,d ->  ['darwin', 'english', 'depp', 'american']
best_3 match for d item ->  ['plays', 'actor', 'comedy']
given true a,b,c,d ->  ['descartes', 'french', 'dickens', 'english']
best_3 match for d item ->  ['british', 'american', 'britain']
given true a,b,c,d ->  ['dostoyevsky', 'russian', 'edison', 'american']
best_3 match for d item ->  ['union', 'motors', 'ukrainian']
given true a,b,c,d ->  ['einstein', 'jewish', 'euclid', 'greek']
best_3 match for d item ->  ['netzarim', 'synagogues', 'settlements']
given true a,b,c,d ->  ['fermi', 'italian', 'galilei', 'italian']
best_3 match for d item ->  ['italy', 'nun', 'francesco']
given true a,b,c,d ->  ['gorbachev', 'russian', 'hawking', 'english']
best_3 match for d item ->  ['bulk', 'specialized', 'sophisticated']
given true a,b,c,d ->  ['hegel', 'german', 'hitler', 'german']
best_3 match for d item ->  ['nazi', 'russian', 'polish']
given true a,b,c,d ->  ['homer', 'greek', 'hume', 'scottish']
best_3 match for d item ->  ['cypriot', 'pākehā', 'koine']
given true a,b,c,d ->  ['jolie', 'america', 'kant', 'german']
best_3 match for d item ->  ['socialism', 'fundamental', 'philosophy']
given true a,b,c,d ->  ['kepler', 'german', 'lavoisier', 'french']
best_3 match for d item ->  ['polish', 'french', 'germans']
given true a,b,c,d ->  ['leibniz', 'german', 'lenin', 'russian']
best_3 match for d item ->  ['russian', 'soviet', 'russia']
given true a,b,c,d ->  ['lennon', 'english', 'lincoln', 'american']
best_3 match for d item ->  ['class', 'served', '—']
given true a,b,c,d ->  ['locke', 'english', 'machiavelli', 'italian']
best_3 match for d item ->  ['translations', 'colloquial', 'translated']
given true a,b,c,d ->  ['marx', 'german', 'maxwell', 'scottish']
best_3 match for d item ->  ['british', 'belgian', 'canadian']
given true a,b,c,d ->  ['mencius', 'chinese', 'Michelangelo', 'italian']
best_3 match for d item ->  ['as', 'also', 'well']
given true a,b,c,d ->  ['mozart', 'german', 'napoleon', 'french']
best_3 match for d item ->  ['germans', 'soviet', 'soviets']
given true a,b,c,d ->  ['newton', 'english', 'pascal', 'french']
best_3 match for d item ->  ['portuguese', 'italian', 'spanish']
given true a,b,c,d ->  ['plato', 'greek', 'raphael', 'italian']
best_3 match for d item ->  ['dutch', 'eurozone', 'french']
given true a,b,c,d ->  ['rousseau', 'french', 'spinoza', 'dutch']
best_3 match for d item ->  ['italian', 'dutch', 'spanish']
given true a,b,c,d ->  ['stalin', 'soviet', 'strauss', 'austrian']
best_3 match for d item ->  ['european', 'u.k.', 'europe']
given true a,b,c,d ->  ['tchaikovsky', 'russian', 'tolstoi', 'russian']
best_3 match for d item ->  ['afghan', 'enclave', 'tajik']
given true a,b,c,d ->  ['truman', 'american', 'wagner', 'german']
best_3 match for d item ->  ['trio', 'group', 'duo']
best_1 accuracy:  0.04
best_3 accuracy:  0.16
```

In [10]:
```
analogy_accuracy_rate("/Users/nehakardam/Documents/UWclasses /EE517 NLP/Lab
```

```
given true a,b,c,d ->  ['ant', 'black', 'apple', 'red']
best_3 match for d item ->  ['orange', 'brand', 'white']
given true a,b,c,d ->  ['blackboard', 'black', 'blood', 'red']
best_3 match for d item ->  ['causes', 'and', 'face']
given true a,b,c,d ->  ['blueberry', 'blue', 'broccoli', 'green']
best_3 match for d item ->  ['red', 'trimmed', 'brown']
given true a,b,c,d ->  ['bruise', 'blue', 'cabbage', 'green']
best_3 match for d item ->  ['orange', 'apples', 'olive']
given true a,b,c,d ->  ['carrot', 'orange', 'cauliflower', 'green']
best_3 match for d item ->  ['purple', 'florets', 'pink']
given true a,b,c,d ->  ['celery', 'green', 'cherry', 'red']
best_3 match for d item ->  ['white', 'gray', 'jackson']
given true a,b,c,d ->  ['chocolate', 'brown', 'cloud', 'white']
best_3 match for d item ->  ['guard', 'foley', 'reserve']
given true a,b,c,d ->  ['coal', 'black', 'coffee', 'black']
best_3 match for d item ->  ['shirt', 'shirts', 'dress']
given true a,b,c,d ->  ['cranberry', 'red', 'cream', 'white']
best_3 match for d item ->  ['blue', 'black', 'yellow']
given true a,b,c,d ->  ['crow', 'black', 'cucumber', 'green']
best_3 match for d item ->  ['chopped', 'onion', 'diced']
given true a,b,c,d ->  ['emerald', 'green', 'fridge', 'whitek']
best_3 match for d item ->  ['filling', 'fill', 'refrigerator']
given true a,b,c,d ->  ['frog', 'green', 'grapes', 'black']
best_3 match for d item ->  ['olive', 'wines', 'sauvignon']
given true a,b,c,d ->  ['grass', 'green', 'leaves', 'green']
best_3 match for d item ->  ['brown', 'white', 'bright']
given true a,b,c,d ->  ['milk', 'white', 'paper', 'white']
best_3 match for d item ->  ['pointed', 'framed', 'gray']
given true a,b,c,d ->  ['parsley', 'green', 'peony', 'red']
best_3 match for d item ->  ['mural', 'disneyland', 'exhibit']
given true a,b,c,d ->  ['pepper', 'black', 'potato', 'brown']
best_3 match for d item ->  ['traditional', 'resemble', 'popular']
given true a,b,c,d ->  ['radish', 'red', 'raven', 'black']
best_3 match for d item ->  ['golden', 'rainbow', 'jackson']
given true a,b,c,d ->  ['rose', 'red', 'ruby', 'red']
best_3 match for d item ->  ['purple', 'pink', 'buckskin']
given true a,b,c,d ->  ['salt', 'white', 'sapphire', 'blue']
best_3 match for d item ->  ['ruby', 'crouching', 'striped']
given true a,b,c,d ->  ['sea', 'blue', 'sky', 'blue']
best_3 match for d item ->  ['shirt', 'bright', 'pink']
given true a,b,c,d ->  ['snow', 'white', 'soil', 'black']
best_3 match for d item ->  ['protected', 'black', 'green']
given true a,b,c,d ->  ['spinach', 'green', 'sugar', 'white']
best_3 match for d item ->  ['blue', 'black', 'white']
given true a,b,c,d ->  ['sun', 'yellow', 'swan', 'white']
best_3 match for d item ->  ['otter', 'goose', 'mink']
given true a,b,c,d ->  ['tea', 'black', 'tomato', 'red']
best_3 match for d item ->  ['red', 'collar', 'peppers']
given true a,b,c,d ->  ['toothpaste', 'white', 'yoghurt', 'white']
best_3 match for d item ->  ['black', 'green', 'red']
best_1 accuracy:  0.04
best_3 accuracy:  0.12
```

In [ ]: