```
In [42]:  import pymongo
          import pandas as pd
          import numpy as np

          from pymongo import MongoClient
          from bson.objectid import ObjectId

          import datetime

          import matplotlib.pyplot as plt

          from collections import defaultdict


          %matplotlib inline
          import json
          plt.style.use('ggplot')
          import seaborn as sns
          from math import log10, floor
          from time import time
          from sklearn.feature_extraction.text import TfidfVectorizer, CountVectorizer



          from sklearn.cluster import KMeans, MiniBatchKMeans
          from IPython.display import Image
          from IPython.core.display import HTML

          import matplotlib.pyplot as plt
          import urllib.request
```

```
In [2]:   ## Connect to local DB

          client = MongoClient('localhost', 27017)
          print ("Setup db access")
          #
          # Get collections from mongodb
          #

          db = client.test
```

```
Setup db access
```

```
In [3]:   # Find all qual_id's
          qual_ids =  db.anon_student_task_responses.distinct('qual_id')
```

```
In [4]:   # print (len(qual_ids), qual_ids)
```

In [5]:
```python
# Get count of qual_id with failures
qual_id_counts =  db.anon_student_task_responses.aggregate(
  [{
    '$group': {
      '_id': {
        'qual_id': '$qual_id'
      },
      'count': {
        '$sum': 1
      }
    }

  }
   ]
)
```

In [6]:
```python
qual_id_counts = list(qual_id_counts)
```

In [7]:
```python
qual_count_df = pd.DataFrame(qual_id_counts)
```

In [8]:
```python
print (qual_id_counts)
```

parta.nWzbkwqg88'}, 'count': 1}, {'_id': {'qual_id': 'FIohvCCngW.parta.2t
VCSx9xM8'}, 'count': 1}, {'_id': {'qual_id': 'FIohvCCngW.parta.ItYOZ2Mjp
Q'}, 'count': 2}, {'_id': {'qual_id': 's4FlyZcPsQ.partb.o-MyTL6oib'}, 'co
unt': 1}, {'_id': {'qual_id': '_tmH4Wd7lx.parta.jeTlRzUVMR'}, 'count':
1}, {'_id': {'qual_id': 'gmKAbYVHOE.parta.NpBAHXqo-F'}, 'count': 1}, {'_i
d': {'qual_id': 'XXf--mNIjj.bonus.KreK2R1-39'}, 'count': 2}, {'_id': {'qu
al_id': 'BbI26g5ijL.parta.mUHMxGVWEl'}, 'count': 1}, {'_id': {'qual_id':
'9WPxMoBH0F.partb.wZ9tufnRk2'}, 'count': 1}, {'_id': {'qual_id': 't-ap-GH
wCR.parta.M__BWubi4G'}, 'count': 2}, {'_id': {'qual_id': 'LaYmTaiTJk.part
a.eKIQc4Pqjb'}, 'count': 2}, {'_id': {'qual_id': 'LaYmTaiTJk.parta.gp0JAU
tPZp'}, 'count': 2}, {'_id': {'qual_id': '0KWOKTSei4.parta.7RIMJh0rgu'},
'count': 1}, {'_id': {'qual_id': '0KWOKTSei4.parta.RBIPf6TRRl'}, 'count':
1}, {'_id': {'qual_id': 'WX-_diOA5G.bonus.Ssebz350BT'}, 'count': 2}, {'_i
d': {'qual_id': '_tmH4Wd7lx.parta._XfGApTKXY'}, 'count': 1}, {'_id': {'qu
al_id': 'YeWlpi-yG4.partb.aaCQpy9mtp'}, 'count': 1}, {'_id': {'qual_id':
'OH_kgnaQCv.partb.xSwz6sE5jI'}, 'count': 1}, {'_id': {'qual_id': 't-ap-GH
wCR.parta.8eKgTmtsE2'}, 'count': 2}, {'_id': {'qual_id': 'LaYmTaiTJk.part
a.zlnwPzNTF-'}, 'count': 2}, {'_id': {'qual_id': 'WX-_diOA5G.bonus.Kte5Ue
NUMq'}, 'count': 1}, {'_id': {'qual_id': 'Xtl-tj5BjN.parta.Y3uzBWB8V6'},

```
In [9]:  print (qual_count_df)
```

	_id	count
0	{'qual_id': 'FIohvCCngW.parta.DNtNNfEZ76'}	1
1	{'qual_id': '6UUZK1Xn5t.partb.6bJn3sN7Vl'}	2
2	{'qual_id': 't-ap-GHwCR.parta.7JzRWxuPIR'}	1
3	{'qual_id': 'FIohvCCngW.parta.dMo4-unXed'}	1
4	{'qual_id': 'FIohvCCngW.parta.nWzbkwqg88'}	1
5	{'qual_id': 'FIohvCCngW.parta.2tVCSx9xM8'}	1
6	{'qual_id': 'FIohvCCngW.parta.ItYOZ2MjpQ'}	2
7	{'qual_id': 's4FlyZcPsQ.partb.o-MyTL6oib'}	1
8	{'qual_id': '_tmH4Wd7lx.parta.jeTlRzUVMR'}	1
9	{'qual_id': 'gmKAbYVHOE.parta.NpBAHXqo-F'}	1
10	{'qual_id': 'XXf--mNIjj.bonus.KreK2R1-39'}	2
11	{'qual_id': 'BbI26g5ijL.parta.mUHMxGVWEl'}	1
12	{'qual_id': '9WPxMoBH0F.partb.wZ9tufnRk2'}	1
13	{'qual_id': 't-ap-GHwCR.parta.M__BWubi4G'}	2
14	{'qual_id': 'LaYmTaiTJk.parta.eKIQc4Pqjb'}	2
15	{'qual_id': 'LaYmTaiTJk.parta.gp0JAUtPZp'}	2
16	{'qual_id': '0KWOKTSei4.parta.7RIMJh0rgu'}	1
17	{'qual_id': '0KWOKTSei4.parta.RBIPf6TRRl'}	1
18	{'qual_id': 'WX-_diOA5G.bonus.Ssebz350BT'}	2
19	{'qual_id': '_tmH4Wd7lx.parta._XfGApTKXY'}	1
20	{'qual_id': 'YeWlpi-yG4.partb.aaCQpy9mtp'}	1
21	{'qual_id': 'OH_kgnaQCv.partb.xSwz6sE5jI'}	1
22	{'qual_id': 't-ap-GHwCR.parta.8eKgTmtsE2'}	2
23	{'qual_id': 'LaYmTaiTJk.parta.zlnwPzNTF-'}	2
24	{'qual_id': 'WX-_diOA5G.bonus.Kte5UeNUMq'}	1
25	{'qual_id': 'Xtl-tj5BjN.parta.Y3uzBWB8V6'}	1
26	{'qual_id': 't-ap-GHwCR.parta.JJdbSBd0AR'}	2
27	{'qual_id': 'WX-_diOA5G.bonus.Wwn7gHV2bO'}	1
28	{'qual_id': 'BbI26g5ijL.parta.ESSbf2Pb8s'}	2
29	{'qual_id': 'V1KViWeAJV.parta.zo_-fljLhE'}	1
...	...	...
27443	{'qual_id': '5ao6mIeuIN.lesson49_3_partb.O08Yc...	68
27444	{'qual_id': 'wnw-ntqg_a.partb.x_xKf6k-i1'}	197
27445	{'qual_id': 'k3AXRA4BRE.bonus.0aKPdbdQVI'}	54
27446	{'qual_id': 'R9jkzw2-4Q.parta.J1_0UU9q7_'}	31
27447	{'qual_id': 'WAAn8yEcZJ.parta.rru6gbdBp8'}	1631
27448	{'qual_id': 'gKph6LE7HV.parta.0glFhFJYTu'}	200
27449	{'qual_id': 'YeWlpi-yG4.partb.zYwO07dVwx'}	6
27450	{'qual_id': 'tCFoIXfgqi.parta.7mY2YAOJJF'}	1397
27451	{'qual_id': 'o9IqlN1J-z.parta.TkWwnXbt0m'}	38
27452	{'qual_id': 'pefFtJ_8oa.parta.ODpjnMmFv0'}	143
27453	{'qual_id': 'yyU0jsjXFO.partb.PUaC_os7tW'}	1408
27454	{'qual_id': 'DebcfZEEmI.partb.OEH-1W96yD'}	353
27455	{'qual_id': 'XSZNVMzN3n.parta.14fTgjyOtN'}	927
27456	{'qual_id': 'ybQjHvfg2c.set1.EEFYXMRQPW'}	145
27457	{'qual_id': '_qty2dzfaI.parta.d7AyKSF_MU'}	214
27458	{'qual_id': 'eSc-FB1B_F.partb.jxWKgZXIHs'}	149
27459	{'qual_id': 'yyU0jsjXFO.partb.UVkc5L9NL4'}	557
27460	{'qual_id': '8sgOeO824Q.partb.yBNi-sgRi_'}	1284
27461	{'qual_id': 'lkqzXK4iws.set3.vRo00L1mzS'}	710
27462	{'qual_id': 'Px5HtjZhgK.upto4.jKNtagBLhQ'}	611
27463	{'qual_id': '5qwW_IZJIz.partb.b8pt2hwGU3'}	143
27464	{'qual_id': 'nqu33m8PC3.parta.RQXLZIobgv'}	18
27465	{'qual_id': 'qIkkuC4fAD.partb.q2ElZZuy7P'}	1254

```
27466          {'qual_id': 'nzaa6a-Zxk.set1.WoGN68L-Db'}    267
27467          {'qual_id': '3GL2qzMC_-.parta.5g1mHAXKlZ'}     14
27468          {'qual_id': 'b2OXBQ-K-L.parta.kB43K7OeYa'}     94
27469          {'qual_id': 'ybQjHvfg2c.set1.ve0p35JAft'}    155
27470          {'qual_id': 'tByvyB3l4w.parta.rURuwd0Q0j'}    119
27471          {'qual_id': '6UUZK1Xn5t.partb.OC_TNthd-b'}      7
27472          {'qual_id': 'qQZqA6CaO_.parta.OOJ2IGN5Jn'}   1688

[27473 rows x 2 columns]
```

In [10]: `qual_count_df = qual_count_df.sort_values(by='count', ascending=**False**)`

```
In [11]: qual_count_df.reset_index(drop=True,inplace=True)
         print (qual_count_df)
```

```
                                              _id   count
0          {'qual_id': 'xSDXuo9OEH.bonus.OG_XxtbnEa'}   22752
1          {'qual_id': 'YN4n4X5GRF.bonus.Q5XY-9tBFu'}   19100
2          {'qual_id': '9wRCzK1G7F.partb.12d_Yq8M01'}   18911
3          {'qual_id': 'TJxldqZMXd.partb.gqJqOrIhu_'}   18390
4          {'qual_id': 'TJxldqZMXd.partb.9L_iTwGd5z'}   18197
5          {'qual_id': 'TJxldqZMXd.partb.W2tLvQTbkI'}   17800
6          {'qual_id': '9wRCzK1G7F.partb.SHkv5F_Yzi'}   17466
7          {'qual_id': 'TJxldqZMXd.partb.hxS1eqLik1'}   17191
8          {'qual_id': '9wRCzK1G7F.partb.qGGEQyiE_j'}   17007
9          {'qual_id': 'kvig7fcCVc.partb.3y7UMHuR_i'}   16876
10         {'qual_id': 'kvig7fcCVc.partb.1jPc7UeCZc'}   16552
11         {'qual_id': '9wRCzK1G7F.partb.dHZqaGepfV'}   16444
12         {'qual_id': '_trDQgmx9g.bonus.S2xjdLDOgA'}   15948
13         {'qual_id': 'UlJYoQjOUR.parta.byIwJMROwV'}   15944
14         {'qual_id': 'HaXmMUnltl.bonus.WB6U9OhvZi'}   14952
15         {'qual_id': '9wRCzK1G7F.partb.75ayW9Wz4k'}   14780
16         {'qual_id': 'kvig7fcCVc.partb.ZKOrrM1K8G'}   14700
17         {'qual_id': 'kvig7fcCVc.partb.eZe6HdH_r_'}   14496
18         {'qual_id': 'pD_1459mfy.partb.aL_Gvm9q0h'}   14183
19         {'qual_id': 'pD_1459mfy.partb.v9XdqzVk22'}   13823
20         {'qual_id': '_d1qnEqMYs.partb.TIL71Bb5gj'}   13655
21         {'qual_id': 'UlJYoQjOUR.partb.ER0z0eSNUG'}   13516
22         {'qual_id': 'kvig7fcCVc.partb.GZo13HUAxn'}   13372
23         {'qual_id': '9wRCzK1G7F.parta.NxWueNsFnx'}   13226
24         {'qual_id': 'pD_1459mfy.partb.pMk-moD0f8'}   13224
25         {'qual_id': 'FmeMEBRHmB.bonus.24M2DNktUG'}   13162
26         {'qual_id': '9wRCzK1G7F.partb.WsTATD5a-k'}   12944
27         {'qual_id': 'kvig7fcCVc.partb.Re5yQZp9Kb'}   12917
28         {'qual_id': 'Syxag5tFow.parta.kg0JZgPiTI'}   12712
29         {'qual_id': 'jun0JnZOzp.partb.C4W9cb9ifk'}   12609
...                                              ...     ...
27443      {'qual_id': 'IRaIcmaWjs.mixed.9Vly1eE0fq'}       1
27444      {'qual_id': 'urBaXsHphv.proper.NrOjfHAbe9'}      1
27445      {'qual_id': 'gmKAbYVHOE.parta.7jd2dUX-Qs'}       1
27446      {'qual_id': 'V1KViWeAJV.parta.C9IQitcJkl'}       1
27447      {'qual_id': 'Tnk5i6prKY.bonus.ylLVgY7qyL'}       1
27448      {'qual_id': 'V1KViWeAJV.parta.Pf2RmIt38D'}       1
27449      {'qual_id': 'wnw-ntqg_a.parta._BxnPUM3qM'}       1
27450      {'qual_id': '0gf4NuFCTT.set1.NxDTv_0mSj'}        1
27451      {'qual_id': 'Ok-iIHxjgx.parta.htJSpwpdhh'}       1
27452      {'qual_id': '29LJstkI0N.parta._qnd1tTA5U'}       1
27453      {'qual_id': '4aSCnZqs4n.set1.bgvtAG5jSW'}        1
27454      {'qual_id': 'fymYH3DPol.set1.Z_a6mXZZDv'}        1
27455      {'qual_id': 'YCnJ90d2QG.partb.cu_0oWx9dD'}       1
27456      {'qual_id': 'odlsWXcSI3.mixed.Xp5uQelqoi'}       1
27457      {'qual_id': 'NSyM52y-Qs.set1.zBeoiqV6mp'}        1
27458      {'qual_id': 's4FlyZcPsQ.partb.vLlTmkdU9L'}       1
27459      {'qual_id': 'odlsWXcSI3.mixed.8Wd40C45Wm'}       1
27460      {'qual_id': 'odlsWXcSI3.mixed.0kwsuDMxRT'}       1
27461   {'qual_id': 'fymYH3DPol.set_only0.5kMYtKqt76'}      1
27462   {'qual_id': 't8suuCs7vN.l31_9_parta.BzNjoMcAuz'}    1
27463      {'qual_id': 'fymYH3DPol.set3.zwLDPIr1id'}        1
27464      {'qual_id': '5qwW_IZJIz.partb.gnqbsSvSGO'}       1
```

```
27465          {'qual_id': 'IRaIcmaWjs.mixed.lirhw9gRRO'}          1
27466          {'qual_id': 'IRaIcmaWjs.mixed.cs89mRLCPy'}          1
27467           {'qual_id': 'WB5Xk0YdVb.set1.ZnTK62pyFE'}          1
27468           {'qual_id': 'pufURj5P3q.set4.1zWmpGhqBt'}          1
27469          {'qual_id': 'iMCBGBUqlz.parta.5PTg4vE64J'}          1
27470          {'qual_id': 'OvOBbA0OaZ.partb.OTqwARekNs'}          1
27471                {'qual_id': 'IVHhngfbBS.W2jt9mZsDQ'}          1
27472          {'qual_id': 'FIohvCCngW.parta.DNtNNfEZ76'}          1

[27473 rows x 2 columns]
```

In [12]:
```
qual_id_fail_counts =  db.anon_student_task_responses.aggregate(
  [{
    '$group': {
     '_id': {
       'qual_id': '$qual_id',
       'correct': 'False'
     },
     'count': {
       '$sum': 1
     }
    }

  }
  ]
)
```

In [13]:
```
qual_id_fail_counts = list(qual_id_fail_counts)
```

In [14]:
```
qual_fail_count_df = pd.DataFrame(qual_id_fail_counts)
```

In [15]:
```
qual_fail_count_df.sort_values(by='count', inplace=True, ascending=False)
```

In [16]: `qual_fail_count_df`

Out[16]:

	_id	count
21573	{'qual_id': 'xSDXuo9OEH.bonus.OG_XxtbnEa', 'co...	22752
19385	{'qual_id': 'YN4n4X5GRF.bonus.Q5XY-9tBFu', 'co...	19100
23535	{'qual_id': '9wRCzK1G7F.partb.12d_Yq8M01', 'co...	18911
26681	{'qual_id': 'TJxldqZMXd.partb.gqJqOrlhu_', 'co...	18390
27443	{'qual_id': 'TJxldqZMXd.partb.9L_iTwGd5z', 'co...	18197
27438	{'qual_id': 'TJxldqZMXd.partb.W2tLvQTbkl', 'co...	17800
27109	{'qual_id': '9wRCzK1G7F.partb.SHkv5F_Yzi', 'co...	17466
25049	{'qual_id': 'TJxldqZMXd.partb.hxS1eqLik1', 'co...	17191
6599	{'qual_id': '9wRCzK1G7F.partb.qGGEQyiE_j', 'co...	17007
26565	{'qual_id': 'kvig7fcCVc.partb.3y7UMHuR_i', 'co...	16876
20581	{'qual_id': 'kvig7fcCVc.partb.1jPc7UeCZc', 'co...	16552
11318	{'qual_id': '9wRCzK1G7F.partb.dHZqaGepfV', 'co...	16444
22319	{'qual_id': '_trDQgmx9g.bonus.S2xjdLDOgA', 'co...	15948
4544	{'qual_id': 'UlJYoQjOUR.parta.byIwJMROwV', 'co...	15944
27452	{'qual_id': 'HaXmMUnltl.bonus.WB6U9OhvZi', 'co...	14952
11057	{'qual_id': '9wRCzK1G7F.partb.75ayW9Wz4k', 'co...	14780
14879	{'qual_id': 'kvig7fcCVc.partb.ZKOrrM1K8G', 'co...	14700
26414	{'qual_id': 'kvig7fcCVc.partb.eZe6HdH_r_', 'co...	14496
16838	{'qual_id': 'pD_1459mfy.partb.aL_Gvm9q0h', 'co...	14183
24419	{'qual_id': 'pD_1459mfy.partb.v9XdqzVk22', 'co...	13823
16304	{'qual_id': '_d1qnEqMYs.partb.TIL71Bb5gj', 'co...	13655
22317	{'qual_id': 'UlJYoQjOUR.partb.ER0z0eSNUG', 'co...	13516
13057	{'qual_id': 'kvig7fcCVc.partb.GZo13HUAxn', 'co...	13372
26867	{'qual_id': '9wRCzK1G7F.parta.NxWueNsFnx', 'co...	13226
18710	{'qual_id': 'pD_1459mfy.partb.pMk-moD0f8', 'co...	13224
23450	{'qual_id': 'FmeMEBRHmB.bonus.24M2DNktUG', 'co...	13162
25907	{'qual_id': '9wRCzK1G7F.partb.WsTATD5a-k', 'co...	12944
27010	{'qual_id': 'kvig7fcCVc.partb.Re5yQZp9Kb', 'co...	12917
22853	{'qual_id': 'Syxag5tFow.parta.kg0JZgPiTl', 'co...	12712
24751	{'qual_id': 'jun0JnZOzp.partb.C4W9cb9ifk', 'co...	12609

		_id	count
...	...		...
5048	{'qual_id': 'WX-_diOA5G.bonus.zEp-rGNtdX', 'co...	1
5046	{'qual_id': 'Ndgh-LYI_Q.set1.1g8LX2TN4w', 'cor...	1
26166	{'qual_id': 'b0xB7OeH8I.FVauNPrvYs', 'correct'...	1
5258	{'qual_id': 'fymYH3DPol.set_only1.wlKynEe_N-',...	1
5260	{'qual_id': 'fymYH3DPol.set3.ksoZkHlasR', 'cor...	1
5349	{'qual_id': 'Ok-iIHxjgx.parta.6A7Qm1iOLM', 'co...	1
5313	{'qual_id': 'pufURj5P3q.set1.7rvnF-BYuz', 'cor...	1
1582	{'qual_id': 's4FlyZcPsQ.partb.VzKoP3g3dQ', 'co...	1
5333	{'qual_id': 'MwmQMh2Sc3.set1.qJKrXMMMj6', 'cor...	1
1588	{'qual_id': 'eSc-FB1B_F.partb.pAaUs_F73h', 'co...	1
5330	{'qual_id': 'UlJYoQjOUR.part_b.0eNYNvcMeG', 'c...	1
24493	{'qual_id': 'fymYH3DPol.set1.Gy-T-xpeeV', 'cor...	1
5316	{'qual_id': 'pufURj5P3q.set1.pmpl-eKzE2', 'cor...	1
24497	{'qual_id': '41wwVr8j3I.set1.x2xHmCD1-6', 'cor...	1
24498	{'qual_id': 'tO12cxwkdc.parta.gQtLl8z7lO', 'co...	1
1600	{'qual_id': 'FlohvCCngW.parta.W3jfrRubzK', 'co...	1
5314	{'qual_id': 'pufURj5P3q.set1.a0yHJ5AjQt', 'cor...	1
5304	{'qual_id': 'EDkkwkoA5r.set3.rgGpNAo_em', 'cor...	1
5265	{'qual_id': 'W_6v_cGOhW.set1.3P2rJoW2eA', 'cor...	1
26215	{'qual_id': 't-ap-GHwCR.parta._ozJpHJct1', 'co...	1
5303	{'qual_id': '6nBHKepQ3Y.set1.arNOdx0Sj7', 'cor...	1
5293	{'qual_id': 'xXRLpqHt26.set1.3J89hyh93P', 'cor...	1
5292	{'qual_id': 'EDkkwkoA5r.set_only0.4Gim1vhClk',...	1
5289	{'qual_id': 'EDkkwkoA5r.set_only1.27VvpfdE5P',...	1
5288	{'qual_id': 'EDkkwkoA5r.set3.r497JyL9tN', 'cor...	1
26201	{'qual_id': 'Xtl-tj5BjN.parta.DM_xcJ97p6', 'co...	1
5283	{'qual_id': 'EDkkwkoA5r.set3.7e3w4zJaK1', 'cor...	1
1641	{'qual_id': 'urBaXsHphv.proper.NrOjfHAbe9', 'c...	1
24526	{'qual_id': 'YBMMW3pDYs.bonus.WUxb3U-EcO', 'co...	1
0	{'qual_id': 'FlohvCCngW.parta.DNtNNfEZ76', 'co...	1

27473 rows × 2 columns

In [17]:
```python
## Functions for turning dictionary into document

def make_string_from_list(key, elem_list):
    # Append key to each item in list
    ans = ''
    for elem in elem_list:
        ans += key + '_' + elem




def make_string(elem, key=None, top=True):
    ans = ''
    if not elem:
        return ans
    if top:
        top = False
        top_keys = []
        for idx in range(len(elem.keys())):
            top_keys.append(True)

    for idx, key in enumerate(elem.keys()):
        if top_keys[idx]:
            top = True
            top_keys[idx] = False
            ans += ' '
        else:
            top = False
        #print ('ans = ', ans)
        #print (type(elem[key]))
        if type(elem[key]) is str or\
                type(elem[key]) is int:
            #print ('add value', elem[key])
            value = str(elem[key])
            #ans += key + '_' + value + ' ' + value + ' '
            ans += key + '_' + value + ' '
        elif type(elem[key]) is list:
            #print ('add list', elem[key])
            temp_elem = dict()
            for item in elem[key]:
                temp_elem[key] = item
                ans += make_string(temp_elem, top)
        elif type(elem[key]) is dict:
            #print ('add dict', elem[key])
            for item_key in elem[key].keys():
                temp_elem = dict()
                temp_elem[item_key] = elem[key][item_key]
                ans += key + '_' + make_string(temp_elem, top)
        elif type(elem[key]) is float:
            #print ('add dict', elem[key])
            sig = 2
            value = elem[key]
            value = round(value, sig-int(
            floor(log10(abs(value))))-1)
            value = str(value)
```

```
          #ans += key + '_' + value + ' ' + value + ' '
          ans += key + '_' + value + ' '
      # ans += ' ' + key + ' '
      #print ('not handled', elem[key])


      return ans
```

In [18]:
```
def make_doc_data_set(prob_set):
    df3 = pd.DataFrame(list(prob_set))
    df3['response_doc'] = df3['response'].map(make_string)
    df3['response_doc'] = df3['response_doc'].map(lambda x: x + ' ')
    df3['response_doc'] = df3['response_doc'].map(lambda x: x.replace('/','_
    df3['response_doc'] = df3['response_doc'] + ' ' + df3['txt']
    df3['response_doc'] = df3['response_doc'].map(lambda x: x + ' ')
    df3['response_doc'] = df3['response_doc'].map(lambda x: x.replace("\n",
    df3['response_doc'] = df3['response_doc'].map(lambda x: x.replace("?", '
    return df3
```

In [19]:
```
def make_k_means(data_samples, n_features=200, n_topic=30, n_top_words=10, d
    n_samples = len(data_samples)
    print("Extracting tf-idf features ...")
    tfidf_vectorizer = TfidfVectorizer(max_df=0.95, min_df=2,
                                        max_features=n_features,
                                        stop_words='english')
    t0 = time()
    tfidf = tfidf_vectorizer.fit_transform(data_samples)
    print("done in %0.3fs." % (time() - t0))

    # Number of clusters
    true_k = clusters
    km = MiniBatchKMeans(n_clusters=true_k, init='k-means++', n_init=1,
                          init_size=1000, batch_size=1000, random_state=4
    print("Clustering with %s" % km)
    t0 = time()
    km.fit(tfidf)
    print("done in %0.3fs" % (time() - t0))
    return km
```

In [20]: `top_ten_qual_id = qual_count_df[:10]`

In [21]: `this_qid = top_ten_qual_id.iloc[0]['_id']['qual_id']`

In [22]:
```
top_ten_qual_id
```

Out[22]:

	_id	count
0	{'qual_id': 'xSDXuo9OEH.bonus.OG_XxtbnEa'}	22752
1	{'qual_id': 'YN4n4X5GRF.bonus.Q5XY-9tBFu'}	19100
2	{'qual_id': '9wRCzK1G7F.partb.12d_Yq8M01'}	18911
3	{'qual_id': 'TJxldqZMXd.partb.gqJqOrlhu_'}	18390
4	{'qual_id': 'TJxldqZMXd.partb.9L_iTwGd5z'}	18197
5	{'qual_id': 'TJxldqZMXd.partb.W2tLvQTbkI'}	17800
6	{'qual_id': '9wRCzK1G7F.partb.SHkv5F_Yzi'}	17466
7	{'qual_id': 'TJxldqZMXd.partb.hxS1eqLik1'}	17191
8	{'qual_id': '9wRCzK1G7F.partb.qGGEQyiE_j'}	17007
9	{'qual_id': 'kvig7fcCVc.partb.3y7UMHuR_i'}	16876

In [47]:
```
df_top_ten = []
```

In [49]:
```python
for row in range(len(top_ten_qual_id)):
    # print (top_ten_qual_id.iloc[row]['_id']['qual_id'], top_ten_qual_id.i
    
    this_qid = top_ten_qual_id.iloc[row]['_id']['qual_id']
    count = top_ten_qual_id.iloc[row]['count']
    print ('Analysis {0} for qual_id {1} with {2} samples'.format(row, this_
    
    
    prob_set = db.anon_student_task_responses.find({'qual_id':this_qid, 'col
    df3 = make_doc_data_set(prob_set)
    print ('Session 0 txt ', df3.iloc[0]['txt'])
    df_top_ten.append(df3.copy())
    data_samples = df3['response_doc']
    km = make_k_means(data_samples, clusters=10)
    df3['cluster'] = km.labels_
    print ('qual_id {0} has these clusters'.format(this_qid))
    print (df3['cluster'].value_counts())
    
    
    columns = 4
    num_images = 8
    # Look at top four clusters
    # Print
    for cluster in (df3['cluster'].value_counts().keys())[:4]:
        plt.clf
        plt.figure(figsize=(20,10))
        print ('Cluster', cluster )
        
        cluster_data = df3[df3['cluster']==cluster]
        #print (cluster_data[:10])
        images = []
        for idx in range(min(num_images, df3['cluster'].value_counts()[clust
            #     images.append(Image(cluster_data.iloc[idx]['screenshot_url
            # create a file-like object from the url
            print (cluster_data.iloc[idx]['screenshot_url'])
            try:
                f = urllib.request.urlopen(cluster_data.iloc[idx]['screensho
            except:
                print(' could not read {0}'.format(cluster_data.iloc[idx]['s
                continue
            # read the image file in a numpy array
            a = plt.imread(f)
            #plt.imshow(a)
            #plt.show()
            #print(image)
            #display(image)
            plt.subplot(min(9, df3['cluster'].value_counts()[cluster]) / col
            plt.imshow(a)
            
        plt.show()
```

```
Analysis 0 for qual_id xSDXuo9OEH.bonus.OG_XxtbnEa with 22752 samples
Session 0 txt  Model a fraction that is equal to  1/4  of the black circl
```

```
e
by covering it with red  1/12  pieces.
Answer: [object Object]
Extracting tf-idf features ...
done in 1.526s.
Clustering with MiniBatchKMeans(batch_size=1000, compute_labels=True, ini
t='k-means++',
        init_size=1000, max_iter=100, max_no_improvement=10, n_clusters=1
0,
        n_init=1, random_state=42, reassignment_ratio=0.01, tol=0.0,
        verbose=0)
done in 0.054s
qual_id xSDXuo9OEH.bonus.OG_XxtbnEa has these clusters
4    3095
1    2091
3    1538
0    1530
2    1271
5    1231
8    1038
9     938
7     825
6     383
Name: cluster, dtype: int64
Cluster 4
http://woot_math_cub.s3.amazonaws.com/ss/74237/OG_XxtbnEa.1470633418484.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74237/OG_XxtbnEa.14706334184
84.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74332/OG_XxtbnEa.14703903289
53.png)
http://woot_math_cub.s3.amazonaws.com/ss/74649/OG_XxtbnEa.1470767152263.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74649/OG_XxtbnEa.14707671522
63.png)
 could not read http://woot_math_cub.s3.amazonaws.com/ss/74649/OG_XxtbnE
a.1470767152263.png (http://woot_math_cub.s3.amazonaws.com/ss/74649/OG_Xx
tbnEa.1470767152263.png)
http://woot_math_cub.s3.amazonaws.com/ss/74917/OG_XxtbnEa.1471179457069.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74917/OG_XxtbnEa.14711794570
69.png)
http://woot_math_cub.s3.amazonaws.com/ss/74226/OG_XxtbnEa.1471323716378.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74226/OG_XxtbnEa.14713237163
78.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74238/OG_XxtbnEa.14713194517
60.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74226/OG_XxtbnEa.14713236131
82.png)
http://woot_math_cub.s3.amazonaws.com/ss/74225/OG_XxtbnEa.1471336179081.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74225/OG_XxtbnEa.14713361790
81.png)
```
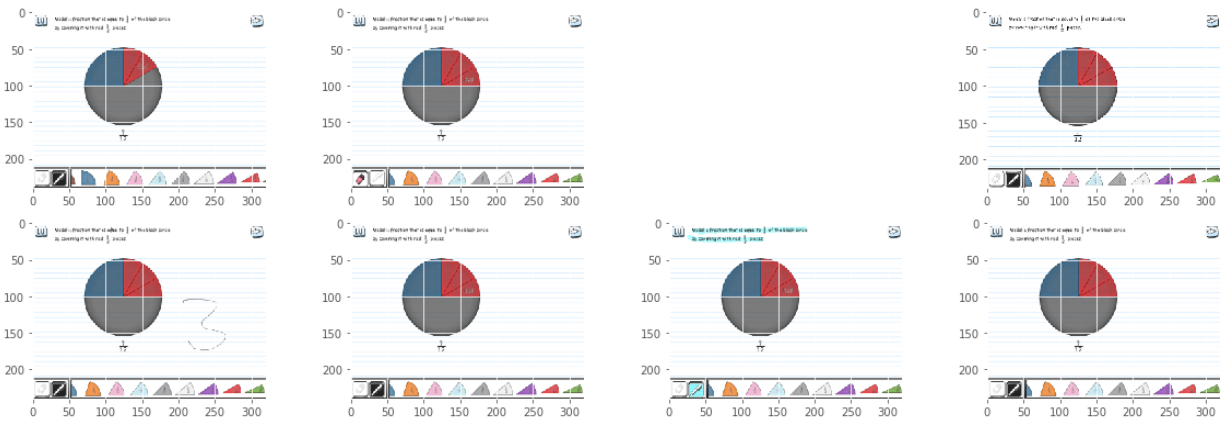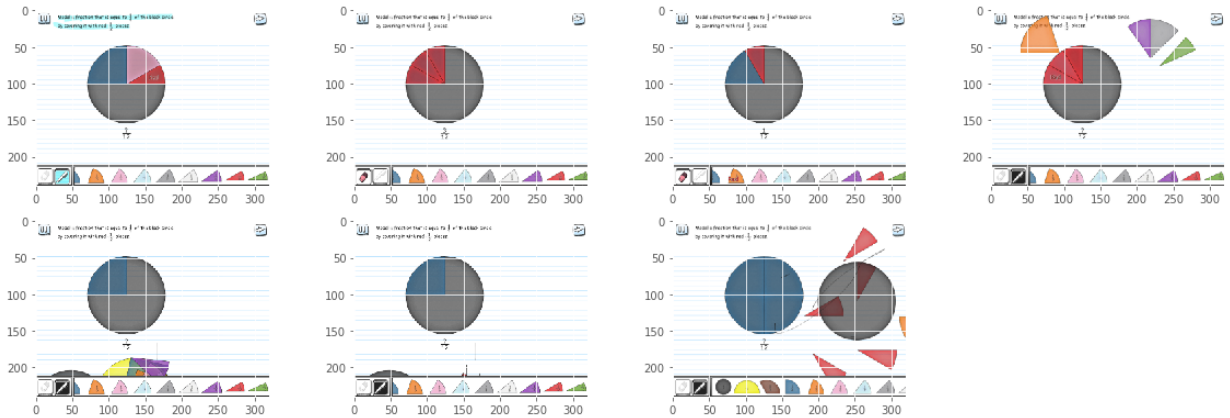
Cluster 1

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ng (http://woot_math_cub.s3.amazonaws.com/ss/74332/OG_XxtbnEa.14703904519
65.png)

 could not read http://woot_math_cub.s3.amazonaws.com/ss/74332/OG_XxtbnE
a.1470390451965.png (http://woot_math_cub.s3.amazonaws.com/ss/74332/OG_Xx
tbnEa.1470390451965.png)

http://woot_math_cub.s3.amazonaws.com/ss/74348/OG_XxtbnEa.1470763790898.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74348/OG_XxtbnEa.14707637908
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74230/OG_XxtbnEa.14713891135
89.png)

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65.png)

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Cluster 3

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79.png)

Cluster 0
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57.png)
 could not read http://woot_math_cub.s3.amazonaws.com/ss/77571/OG_XxtbnE
a.1472753115057.png (http://woot_math_cub.s3.amazonaws.com/ss/77571/OG_Xx
tbnEa.1472753115057.png)

Analysis 1 for qual_id YN4n4X5GRF.bonus.Q5XY-9tBFu with 19100 samples
Session 0 txt   Model a fraction that is equal to 1/2 using the one twelft
h red pieces.
Answer: [object Object]
Extracting tf-idf features ...
done in 0.945s.
Clustering with MiniBatchKMeans(batch_size=1000, compute_labels=True, ini
t='k-means++',
        init_size=1000, max_iter=100, max_no_improvement=10, n_clusters=1
0,
        n_init=1, random_state=42, reassignment_ratio=0.01, tol=0.0,
        verbose=0)
done in 0.046s
qual_id YN4n4X5GRF.bonus.Q5XY-9tBFu has these clusters
6   991
2   830
7   672
9   634
8   579
3   555
4   303
1   250
5   177
0   76
Name: cluster, dtype: int64
Cluster 6
http://woot_math_cub.s3.amazonaws.com/ss/74237/Q5XY-9tBFu.1470633048978.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74237/Q5XY-9tBFu.14706330489
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74232/Q5XY-9tBFu.14713028630
19.png)
http://woot_math_cub.s3.amazonaws.com/ss/74239/Q5XY-9tBFu.1471821851136.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74239/Q5XY-9tBFu.14718218511
36.png)
http://woot_math_cub.s3.amazonaws.com/ss/77773/Q5XY-9tBFu.1472841562947.p

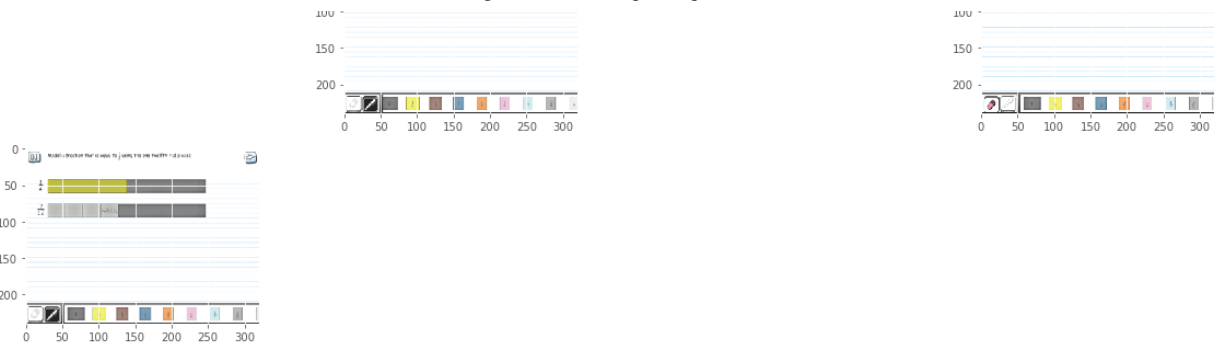ng (http://woot_math_cub.s3.amazonaws.com/ss/77773/Q5XY-9tBFu.14728415629
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ng (http://woot_math_cub.s3.amazonaws.com/ss/76901/Q5XY-9tBFu.14731719969
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ng (http://woot_math_cub.s3.amazonaws.com/ss/77781/Q5XY-9tBFu.14731936017
52.png)

Cluster 2
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74237/Q5XY-9tBFu.14706330419
78.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74252/Q5XY-9tBFu.14713890757
19.png)
http://woot_math_cub.s3.amazonaws.com/ss/74233/Q5XY-9tBFu.1471904641794.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74233/Q5XY-9tBFu.14719046417
94.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74233/Q5XY-9tBFu.14722902217
23.png)
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35.png)
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13.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/77818/Q5XY-9tBFu.14728330527
61.png)

Cluster 7

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u.1472839884141.png (http://woot_math_cub.s3.amazonaws.com/ss/75505/Q5XY-
9tBFu.1472839884141.png)

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ng (http://woot_math_cub.s3.amazonaws.com/ss/77761/Q5XY-9tBFu.14728412751
53.png)

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ng (http://woot_math_cub.s3.amazonaws.com/ss/77772/Q5XY-9tBFu.14728416469
07.png)

 could not read http://woot_math_cub.s3.amazonaws.com/ss/77772/Q5XY-9tBF
u.1472841646907.png (http://woot_math_cub.s3.amazonaws.com/ss/77772/Q5XY-
9tBFu.1472841646907.png)

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ng (http://woot_math_cub.s3.amazonaws.com/ss/75823/Q5XY-9tBFu.14728452595
24.png)

http://woot_math_cub.s3.amazonaws.com/ss/77774/Q5XY-9tBFu.1472846584154.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/77774/Q5XY-9tBFu.14728465841
54.png)

 could not read http://woot_math_cub.s3.amazonaws.com/ss/77774/Q5XY-9tBF
u.1472846584154.png (http://woot_math_cub.s3.amazonaws.com/ss/77774/Q5XY-
9tBFu.1472846584154.png)

http://woot_math_cub.s3.amazonaws.com/ss/76901/Q5XY-9tBFu.1473254301884.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/76901/Q5XY-9tBFu.14732543018
84.png)

 could not read http://woot_math_cub.s3.amazonaws.com/ss/76901/Q5XY-9tBF
u.1473254301884.png (http://woot_math_cub.s3.amazonaws.com/ss/76901/Q5XY-
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ng (http://woot_math_cub.s3.amazonaws.com/ss/77187/Q5XY-9tBFu.14732576489
53.png)

 could not read http://woot_math_cub.s3.amazonaws.com/ss/77187/Q5XY-9tBF

u.1473257648953.png (http://woot_math_cub.s3.amazonaws.com/ss/77187/Q5XY-
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Cluster 9

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ng (http://woot_math_cub.s3.amazonaws.com/ss/76831/Q5XY-9tBFu.14867511430
06.png)
http://woot_math_cub.s3.amazonaws.com/ss/76831/Q5XY-9tBFu.1486751170221.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/76831/Q5XY-9tBFu.14867511702
21.png)
http://woot_math_cub.s3.amazonaws.com/ss/104940/Q5XY-9tBFu.1486767427209.
png (http://woot_math_cub.s3.amazonaws.com/ss/104940/Q5XY-9tBFu.148676742
7209.png)
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png (http://woot_math_cub.s3.amazonaws.com/ss/106265/Q5XY-9tBFu.148678934
3502.png)
http://woot_math_cub.s3.amazonaws.com/ss/106277/Q5XY-9tBFu.1486999476384.
png (http://woot_math_cub.s3.amazonaws.com/ss/106277/Q5XY-9tBFu.148699947
6384.png)
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6452.png)
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50.png)
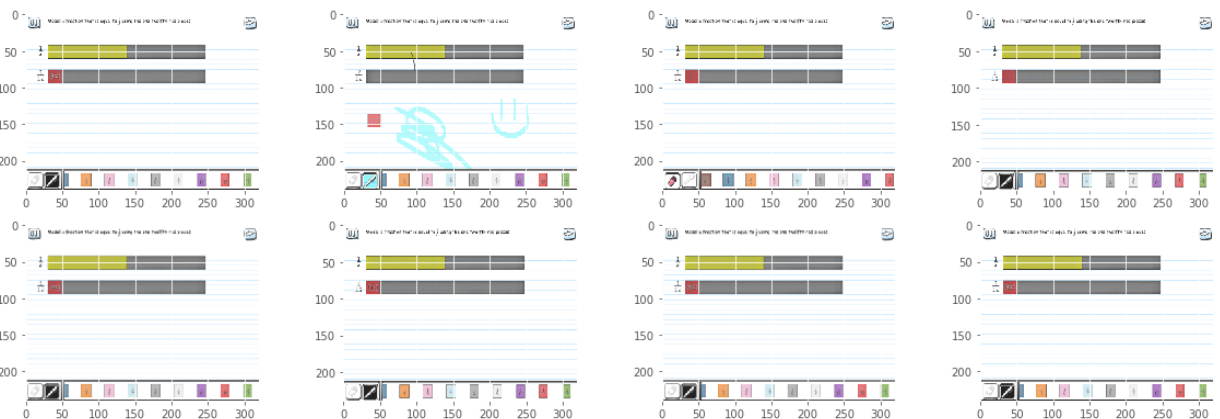
Analysis 2 for qual_id 9wRCzK1G7F.partb.12d_Yq8M01 with 18911 samples
Session 0 txt The brown is the whole unit. Which of these pieces is one
third of the brown piece?
Drag the piece to the answer box.
Answer: 1/9
Extracting tf-idf features ...
done in 0.367s.
Clustering with MiniBatchKMeans(batch_size=1000, compute_labels=True, ini

```
t= k-means++ ,
        init_size=1000, max_iter=100, max_no_improvement=10, n_clusters=1
0,
        n_init=1, random_state=42, reassignment_ratio=0.01, tol=0.0,
        verbose=0)
done in 0.080s
qual_id 9wRCzK1G7F.partb.12d_Yq8M01 has these clusters
6    1132
3     796
0     697
4     509
5     467
1     313
2     283
7     233
9     201
8      33
Name: cluster, dtype: int64
Cluster 6
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74320/12d_Yq8M01.14702985161
94.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74703/12d_Yq8M01.14722205099
00.png)
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10.png)
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91.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/77574/12d_Yq8M01.14727517944
57.png)
http://woot_math_cub.s3.amazonaws.com/ss/77571/12d_Yq8M01.1472751749322.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/77571/12d_Yq8M01.14727517493
22.png)
```

Cluster 3
http://woot_math_cub.s3.amazonaws.com/ss/74249/12d_Yq8M01.1470180407271.p
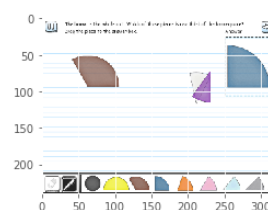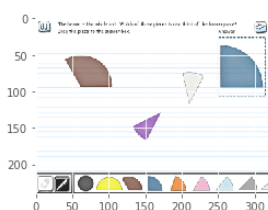ng (http://woot_math_cub.s3.amazonaws.com/ss/74249/12d_Yq8M01.14701804072
71.png)
  could not read http://woot_math_cub.s3.amazonaws.com/ss/74249/12d_Yq8M0
1.1470180407271.png (http://woot_math_cub.s3.amazonaws.com/ss/74249/12d_Y
q8M01.1470180407271.png)
http://woot_math_cub.s3.amazonaws.com/ss/74247/12d_Yq8M01.1470180650644.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74247/12d_Yq8M01.14701806506
44.png)
  could not read http://woot_math_cub.s3.amazonaws.com/ss/74247/12d_Yq8M0
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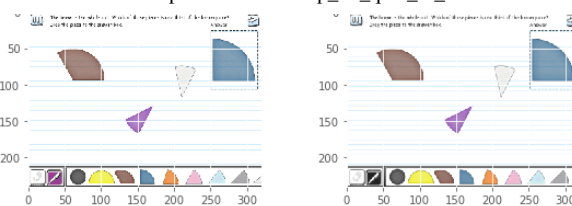ng (http://woot_math_cub.s3.amazonaws.com/ss/73678/12d_Yq8M01.14709301893
49.png)
http://woot_math_cub.s3.amazonaws.com/ss/76147/12d_Yq8M01.1472751519855.p
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55.png)
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64.png)
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82.png)
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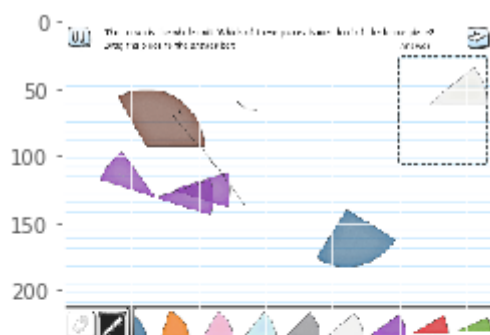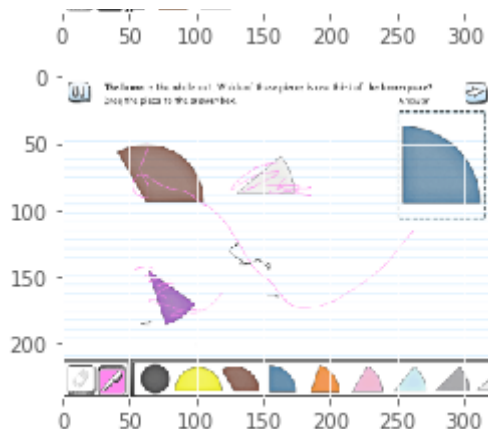
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88.png)
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44.png)
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Cluster 4
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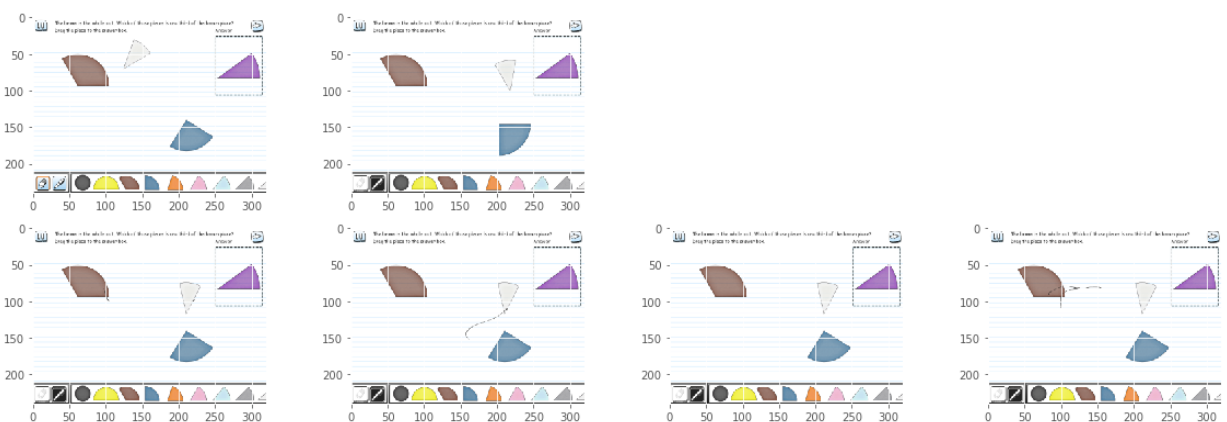
Analysis 3 for qual_id TJxldqZMXd.partb.gqJqOrIhu_ with 18390 samples
Session 0 txt Drag one sixth pieces to cover all of the 2/3 shown.
Answer: 4
Extracting tf-idf features ...
done in 0.297s.
Clustering with MiniBatchKMeans(batch_size=1000, compute_labels=True, ini
t='k-means++'

```
t- K-means++ ,
        init_size=1000, max_iter=100, max_no_improvement=10, n_clusters=1
0,
        n_init=1, random_state=42, reassignment_ratio=0.01, tol=0.0,
        verbose=0)
done in 0.147s
qual_id TJxldqZMXd.partb.gqJqOrIhu_ has these clusters
6     578
1     515
4     367
5     253
2     245
0     239
8     183
7     165
3     109
9      22
Name: cluster, dtype: int64
Cluster 6
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ng (http://woot_math_cub.s3.amazonaws.com/ss/72810/gqJqOrIhu_.14706940319
20.png)
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```

Cluster 1
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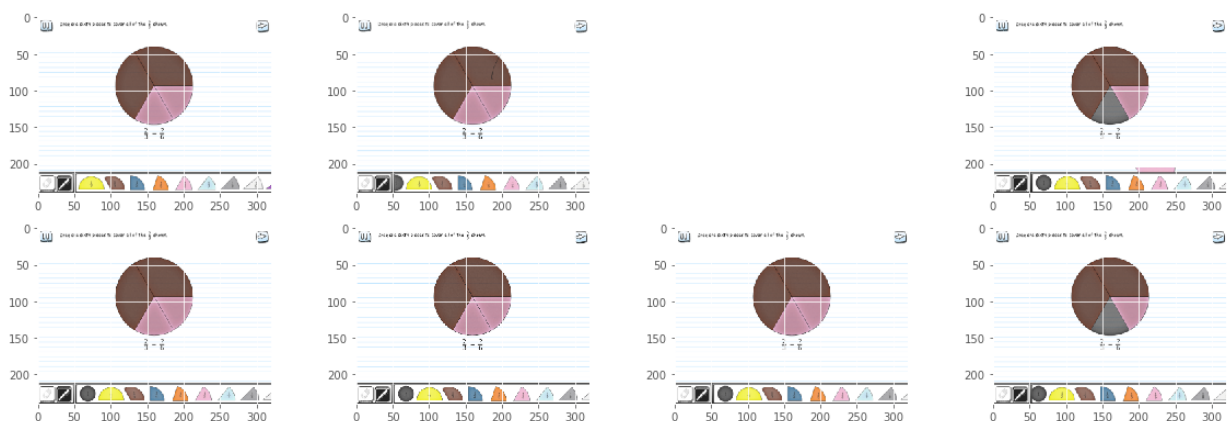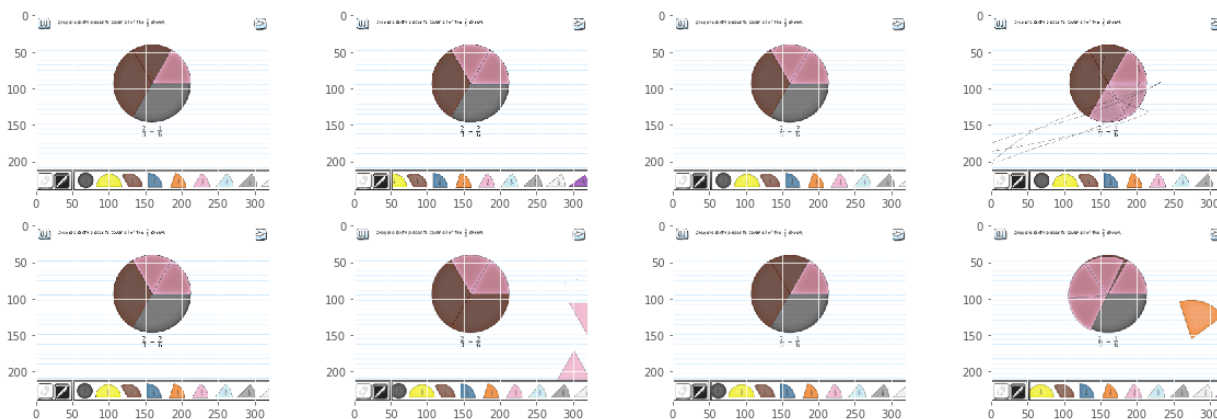http://woot_math_cub.s3.amazonaws.com/ss/76891/gqJqOrIhu_.1473424863009.p
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73.png)
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47.png)

Cluster 4
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38.png)

58.png)
http://woot_math_cub.s3.amazonaws.com/ss/77682/gqJqOrIhu_.1473353013532.p
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32.png)
http://woot_math_cub.s3.amazonaws.com/ss/76902/gqJqOrIhu_.1473361744147.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/76902/gqJqOrIhu_.14733617441
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http://woot_math_cub.s3.amazonaws.com/ss/76891/gqJqOrIhu_.1473424822522.p
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22.png)
http://woot_math_cub.s3.amazonaws.com/ss/77226/gqJqOrIhu_.1473626458885.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/77226/gqJqOrIhu_.14736264588
85.png)
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51.png)

Cluster 5
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85.png)
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01.png)
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_.1473265999101.png (http://woot_math_cub.s3.amazonaws.com/ss/77161/gqJqO
rIhu_.1473265999101.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/77102/gqJqOrIhu_.14736953376
69.png)
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32.png)
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rIhu_.1473869616032.png)
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46.png)
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rIhu_.1473875446446.png)
http://woot_math_cub.s3.amazonaws.com/ss/82930/gqJqOrIhu_.1473873213166.p
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66.png)
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_.1473873213166.png (http://woot_math_cub.s3.amazonaws.com/ss/82930/gqJqO
rIhu_.1473873213166.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/77094/gqJqOrIhu_.14744662178
98.png)
 could not read http://woot_math_cub.s3.amazonaws.com/ss/77094/gqJqOrIhu
_.1474466217898.png (http://woot_math_cub.s3.amazonaws.com/ss/77094/gqJqO
rIhu_.1474466217898.png)
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70.png)
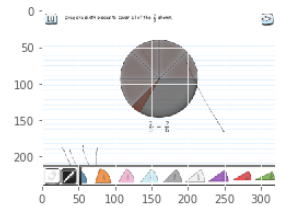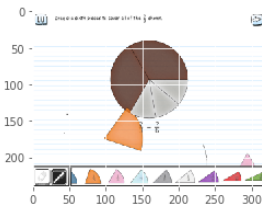
Analysis 4 for qual_id TJxldqZMXd.partb.9L_iTwGd5z with 18197 samples
Session 0 txt Drag one eighth pieces to cover all of the 3/4 shown.
Answer: 6
Extracting tf-idf features ...
done in 0.334s.
Clustering with MiniBatchKMeans(batch_size=1000, compute_labels=True, ini
t='k-means++',
        init_size=1000, max_iter=100, max_no_improvement=10, n_clusters=1
0,
        n_init=1, random_state=42, reassignment_ratio=0.01, tol=0.0,
        verbose=0)
done in 0.137s
qual_id TJxldqZMXd.partb.9L_iTwGd5z has these clusters
0   1094
4   409
2   317
1   206
3   144
5   122
8   48
6   34
9   28
7   21

```
Name: cluster, dtype: int64
Cluster 0
http://woot_math_cub.s3.amazonaws.com/ss/74588/9L_iTwGd5z.1470626243705.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74588/9L_iTwGd5z.14706262437
05.png)
http://woot_math_cub.s3.amazonaws.com/ss/74703/9L_iTwGd5z.1472221390322.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74703/9L_iTwGd5z.14722213903
22.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74703/9L_iTwGd5z.14722213982
01.png)
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07.png)
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08.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74843/9L_iTwGd5z.14726865048
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74843/9L_iTwGd5z.14726865094
57.png)
http://woot_math_cub.s3.amazonaws.com/ss/77572/9L_iTwGd5z.1472753050504.p
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04.png)
```
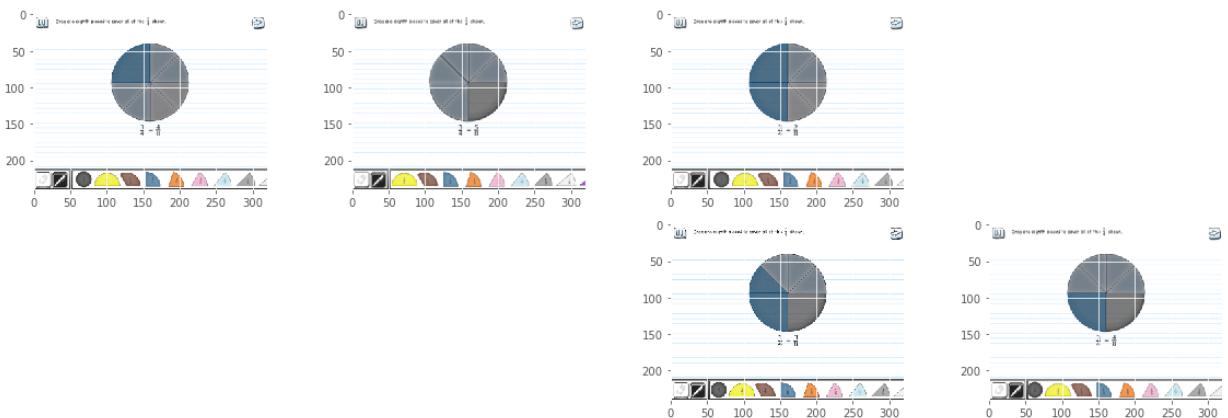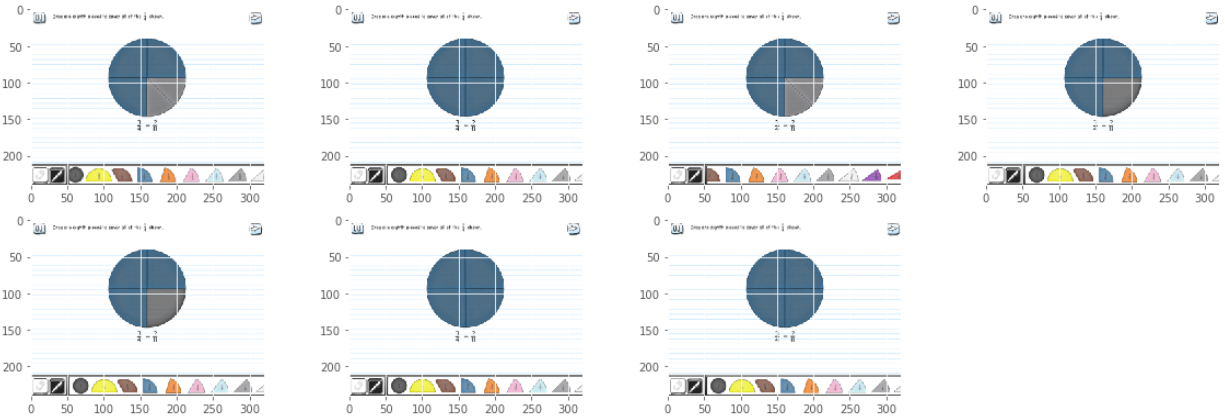


```
Cluster 4
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42.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74843/9L_iTwGd5z.14726863025
51.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/77573/9L_iTwGd5z.14727527399
65.png)
```

http://woot_math_cub.s3.amazonaws.com/ss/77682/9L_iTwGd5z.1473352885416.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/77682/9L_iTwGd5z.14733528854
16.png)
 could not read http://woot_math_cub.s3.amazonaws.com/ss/77682/9L_iTwGd5
z.1473352885416.png (http://woot_math_cub.s3.amazonaws.com/ss/77682/9L_iT
wGd5z.1473352885416.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/77682/9L_iTwGd5z.14733531783
43.png)
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wGd5z.1473353178343.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/77682/9L_iTwGd5z.14733532304
25.png)
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z.1473353230425.png (http://woot_math_cub.s3.amazonaws.com/ss/77682/9L_iT
wGd5z.1473353230425.png)
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07.png)
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74.png)

Cluster 2
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31.png)
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68.png)
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76.png)
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wGd5z.1473445608571.png)

Cluster 1
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88.png)
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z.1473266000688.png (http://woot_math_cub.s3.amazonaws.com/ss/77161/9L_iT
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69.png)
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z.1473695339769.png (http://woot_math_cub.s3.amazonaws.com/ss/77102/9L_iT
wGd5z.1473695339769.png)
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58.png)
 could not read http://woot_math_cub.s3.amazonaws.com/ss/85101/9L_iTwGd5
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wGd5z.1475706143958.png)

<matplotlib.figure.Figure at 0x1639849b0>

Analysis 5 for qual_id TJxldqZMXd.partb.W2tLvQTbkI with 17800 samples
Session 0 txt Drag one half pieces to cover all of the 2/4 shown.
Answer: 1
Extracting tf-idf features ...
done in 0.227s.
Clustering with MiniBatchKMeans(batch_size=1000, compute_labels=True, ini
t='k-means++',
        init_size=1000, max_iter=100, max_no_improvement=10, n_clusters=1
0,
        n_init=1, random_state=42, reassignment_ratio=0.01, tol=0.0,
        verbose=0)
done in 0.107s
qual_id TJxldqZMXd.partb.W2tLvQTbkI has these clusters
3   707
1   347

7   341
2   254
8   194
6   130
4   127
0   83
9   62
5   47
Name: cluster, dtype: int64
Cluster 3
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74653/W2tLvQTbkI.14707536908
66.png)
http://woot_math_cub.s3.amazonaws.com/ss/74649/W2tLvQTbkI.1470767251181.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74649/W2tLvQTbkI.14707672511
81.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74234/W2tLvQTbkI.14719946533
68.png)
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97.png)
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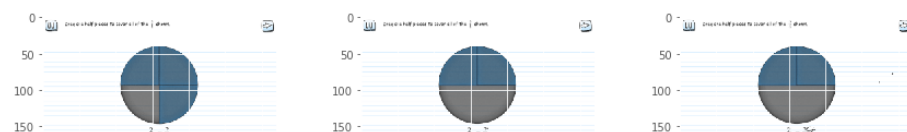ng (http://woot_math_cub.s3.amazonaws.com/ss/74704/W2tLvQTbkI.14727387333
67.png)
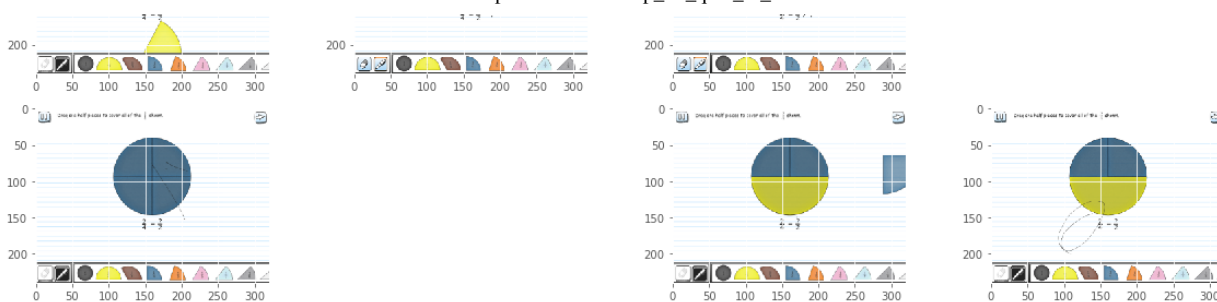http://woot_math_cub.s3.amazonaws.com/ss/77567/W2tLvQTbkI.1472846339710.p

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10.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/77684/W2tLvQTbkI.14733539229
11.png)
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77.png)

Cluster 1
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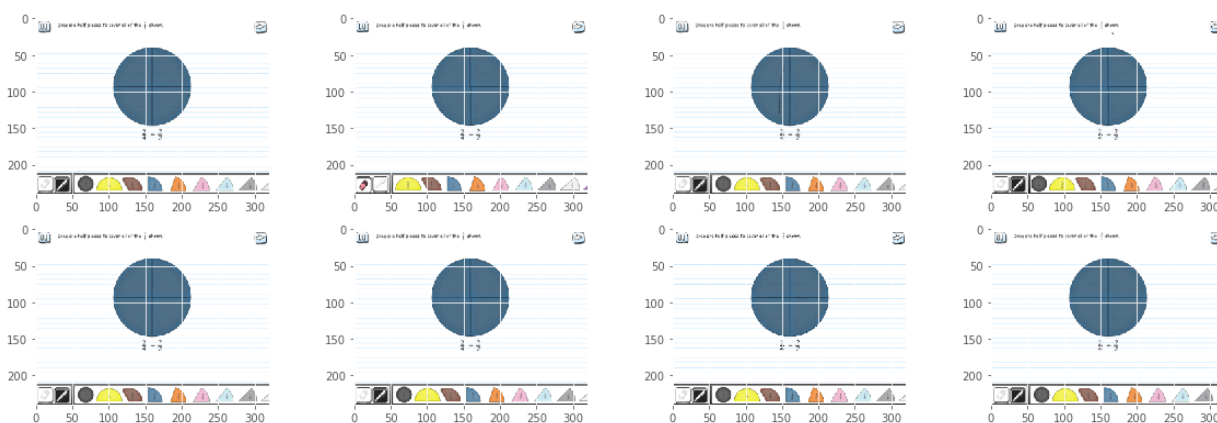ng (http://woot_math_cub.s3.amazonaws.com/ss/74315/W2tLvQTbkI.14705473827
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http://woot_math_cub.s3.amazonaws.com/ss/74228/W2tLvQTbkI.1471331958196.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74228/W2tLvQTbkI.14713319581
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Cluster 7

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Cluster 2

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QTbkI.1473265996271.png)
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QTbkI.1473873208432.png)
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QTbkI.1474391500777.png)
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68.png)
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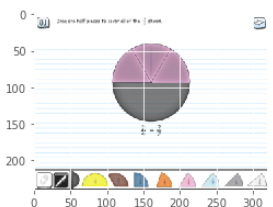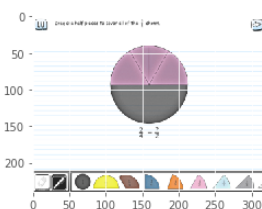
Analysis 6 for qual_id 9wRCzK1G7F.partb.SHkv5F_Yzi with 17466 samples
Session 0 txt The orange is the whole unit. Which of these pieces is one
half of the orange piece?
Drag the piece to the answer box.
Answer: 1/10
Extracting tf-idf features ...
done in 0.823s.
Clustering with MiniBatchKMeans(batch_size=1000, compute_labels=True, ini
t='k-means++',

```
              init_size=1000, max_iter=100, max_no_improvement=10, n_clusters=1
0,
              n_init=1, random_state=42, reassignment_ratio=0.01, tol=0.0,
              verbose=0)
done in 0.085s
qual_id 9wRCzK1G7F.partb.SHkv5F_Yzi has these clusters
1     2314
2     1278
7      808
3      440
9      231
4      194
8      171
5      125
6       32
0        9
Name: cluster, dtype: int64
```

Cluster 1

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21.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74151/SHkv5F_Yzi.14702505464
72.png)
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61.png)
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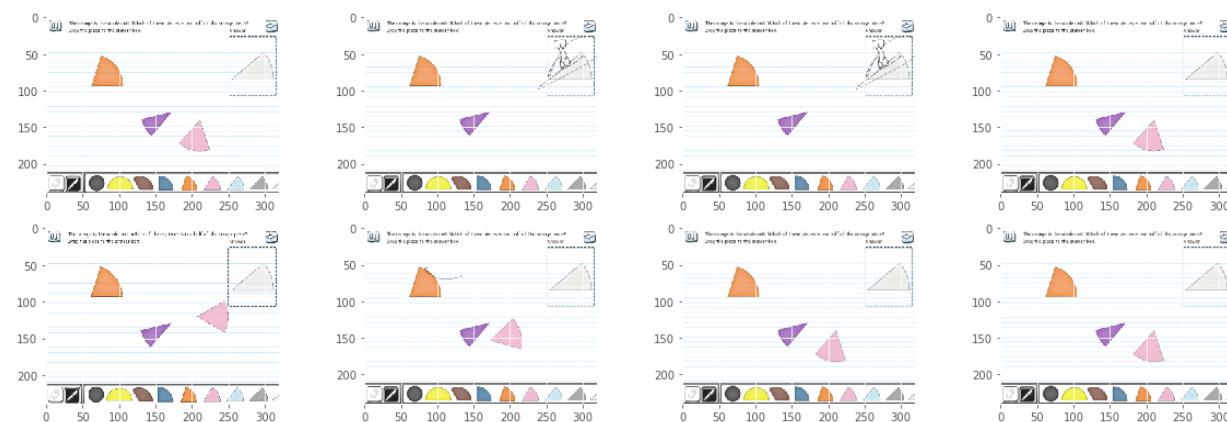http://woot_math_cub.s3.amazonaws.com/ss/74247/SHkv5F_Yzi.1470853754195.p
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26.png)
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Cluster 2

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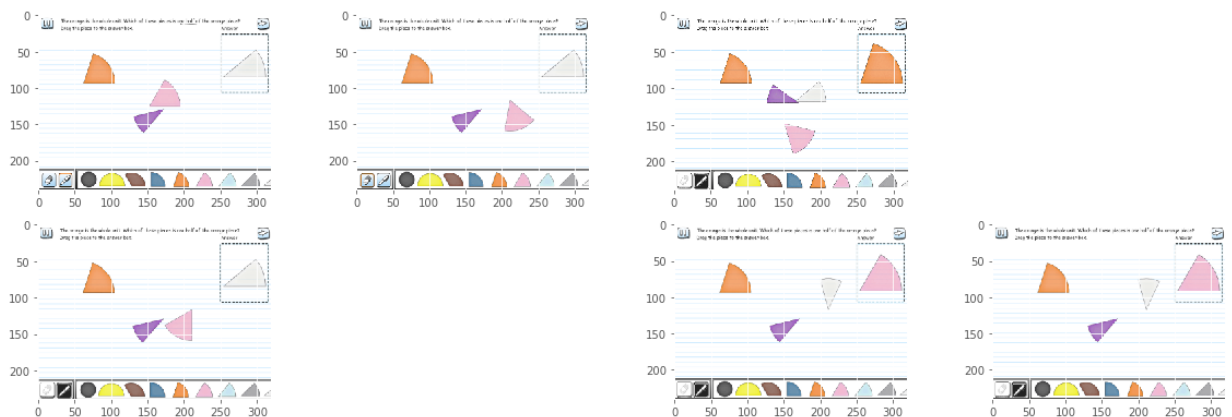F_Yzi.1471453583232.png)
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41.png)

Cluster 7
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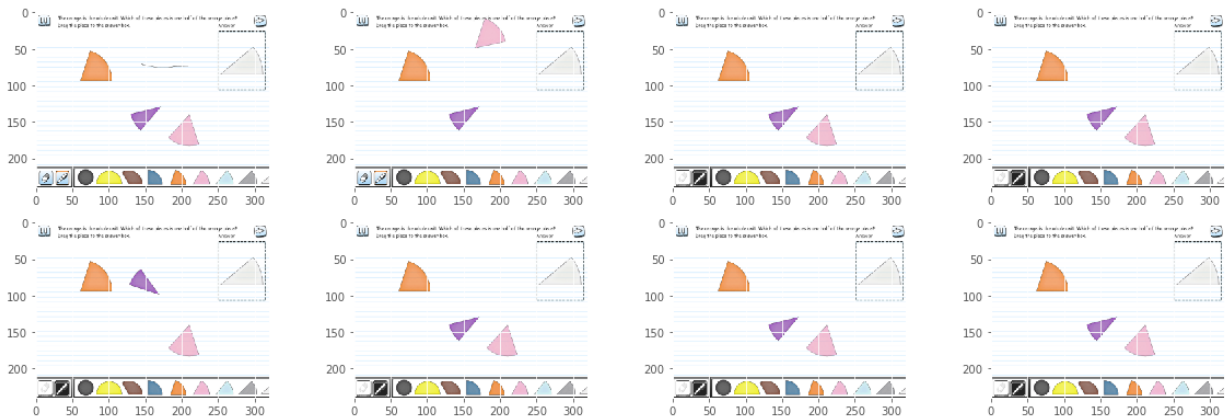77.png)
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86.png)

Cluster 3
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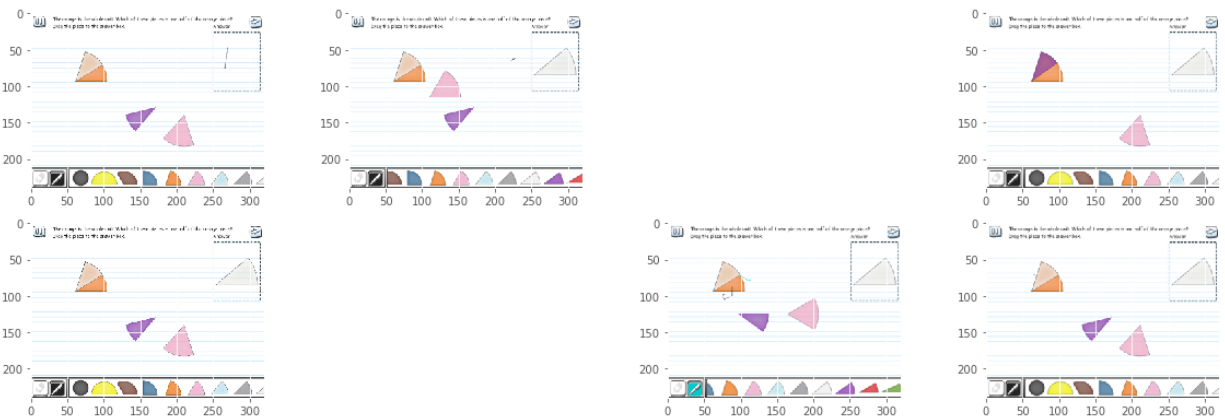
```
Analysis 7 for qual_id TJxldqZMXd.partb.hxS1eqLik1 with 17191 samples
Session 0 txt  Drag one half pieces to cover all of the  4/8  shown.
Answer: 1
Extracting tf-idf features ...
done in 0.110s.
Clustering with MiniBatchKMeans(batch_size=1000, compute_labels=True, ini
t='k-means++',
        init_size=1000, max_iter=100, max_no_improvement=10, n_clusters=1
0,
        n_init=1, random_state=42, reassignment_ratio=0.01, tol=0.0,
        verbose=0)
done in 0.048s
qual_id TJxldqZMXd.partb.hxS1eqLik1 has these clusters
3     265
1     240
5     150
6     121
2      72
0      72
8      46
9      40
4      30
7      22
Name: cluster, dtype: int64
Cluster 3
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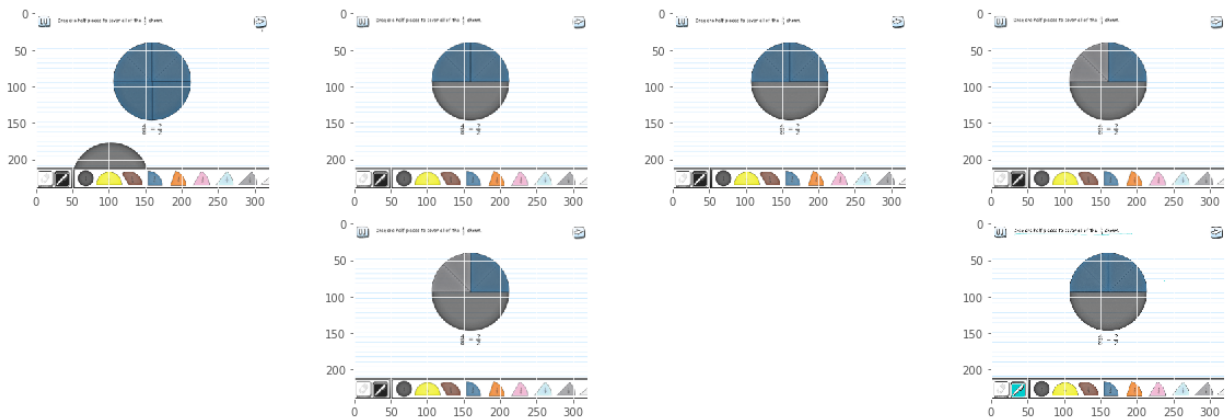
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Cluster 1
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ng (http://woot_math_cub.s3.amazonaws.com/ss/77102/hxS1eqLik1.14736952634
52.png)
 could not read http://woot_math_cub.s3.amazonaws.com/ss/77102/hxS1eqLik
1.1473695263452.png (http://woot_math_cub.s3.amazonaws.com/ss/77102/hxS1e
qLik1.1473695263452.png)
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1.1473695341403.png (http://woot_math_cub.s3.amazonaws.com/ss/77102/hxS1e
qLik1.1473695341403.png)
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99.png)
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1.1473860718499.png (http://woot_math_cub.s3.amazonaws.com/ss/77170/hxS1e
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ng (http://woot_math_cub.s3.amazonaws.com/ss/77554/hxS1eqLik1.14738754593
47.png)
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1.1473875459347.png (http://woot_math_cub.s3.amazonaws.com/ss/77554/hxS1e
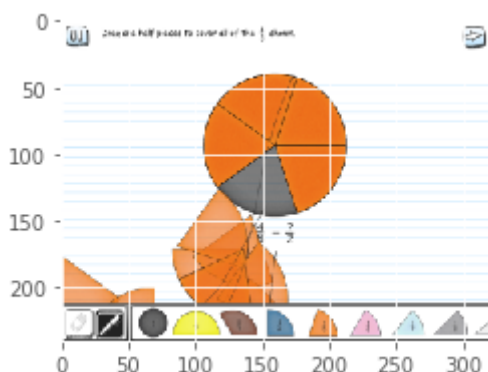
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ng (http://woot_math_cub.s3.amazonaws.com/ss/82930/hxS1eqLik1.14738732191
32.png)
 could not read http://woot_math_cub.s3.amazonaws.com/ss/82930/hxS1eqLik
1.1473873219132.png (http://woot_math_cub.s3.amazonaws.com/ss/82930/hxS1e
qLik1.1473873219132.png)
http://woot_math_cub.s3.amazonaws.com/ss/77094/hxS1eqLik1.1474466220134.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/77094/hxS1eqLik1.14744662201
34.png)
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1.1474466220134.png (http://woot_math_cub.s3.amazonaws.com/ss/77094/hxS1e
qLik1.1474466220134.png)
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25.png)

Cluster 5
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49.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/83178/hxS1eqLik1.14750664501
83.png)
http://woot_math_cub.s3.amazonaws.com/ss/84969/hxS1eqLik1.1475261400595.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/84969/hxS1eqLik1.14752614005
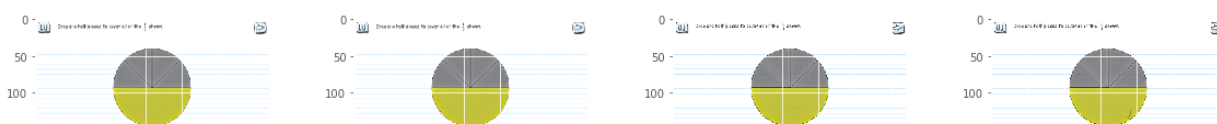95.png)
http://woot_math_cub.s3.amazonaws.com/ss/84969/hxS1eqLik1.1475261423156.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/84969/hxS1eqLik1.14752614231
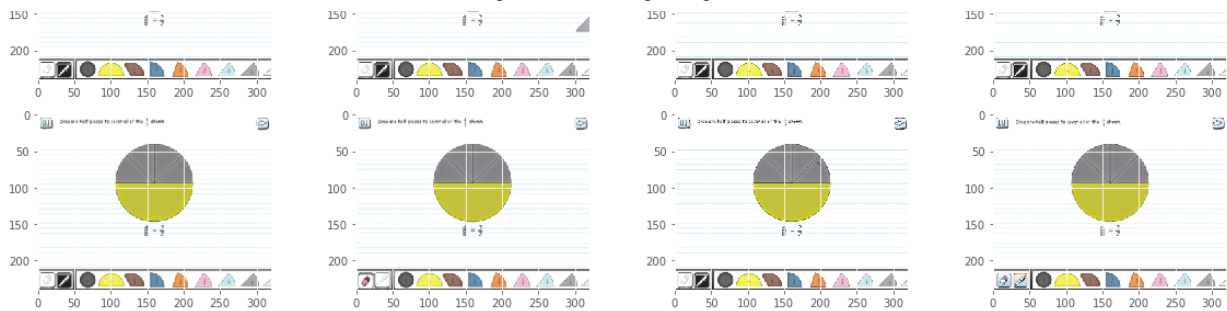56.png)
http://woot_math_cub.s3.amazonaws.com/ss/87230/hxS1eqLik1.1476365055581.p
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ng (http://woot_math_cub.s3.amazonaws.com/ss/86791/hxS1eqLik1.14763760478
58.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/85604/hxS1eqLik1.14763770126
88.png)

Cluster 6
http://woot_math_cub.s3.amazonaws.com/ss/71257/hxS1eqLik1.1471104859613.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/71257/hxS1eqLik1.14711048596
13.png)
http://woot_math_cub.s3.amazonaws.com/ss/72827/hxS1eqLik1.1472227058317.p

ng (http://woot_math_cub.s3.amazonaws.com/ss/72827/hxS1eqLik1.14722270583
17.png)
http://woot_math_cub.s3.amazonaws.com/ss/77102/hxS1eqLik1.1473869665233.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/77102/hxS1eqLik1.14738696652
33.png)
http://woot_math_cub.s3.amazonaws.com/ss/83921/hxS1eqLik1.1474988079833.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/83921/hxS1eqLik1.14749880798
33.png)
http://woot_math_cub.s3.amazonaws.com/ss/84945/hxS1eqLik1.1475624164850.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/84945/hxS1eqLik1.14756241648
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ng (http://woot_math_cub.s3.amazonaws.com/ss/85120/hxS1eqLik1.14757927824
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ng (http://woot_math_cub.s3.amazonaws.com/ss/84849/hxS1eqLik1.14759365809
06.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/85369/hxS1eqLik1.14762854739
32.png)
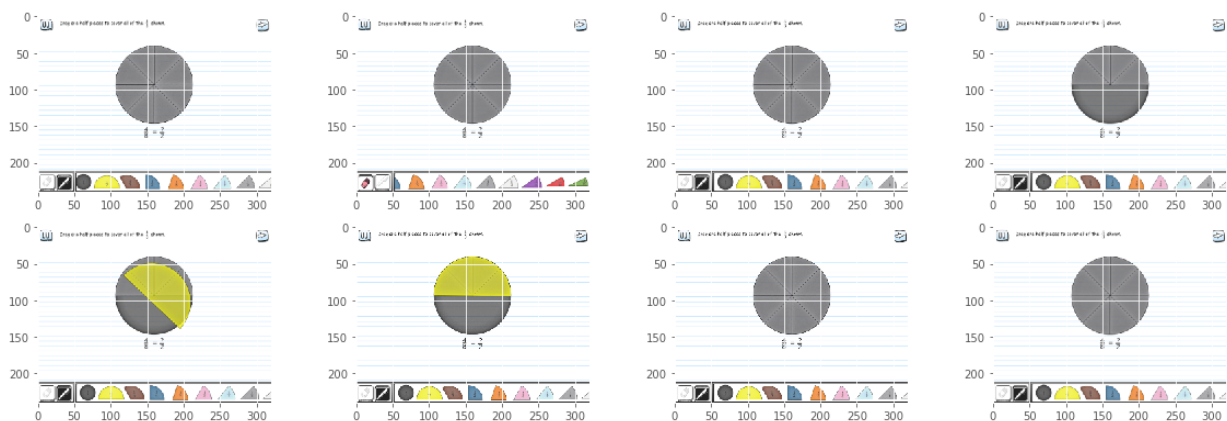
Analysis 8 for qual_id 9wRCzK1G7F.partb.qGGEQyiE_j with 17007 samples
Session 0 txt The yellow is the whole unit. Which of these pieces is one
half of the yellow piece?
Drag the piece to the answer box.
Answer: 1/4
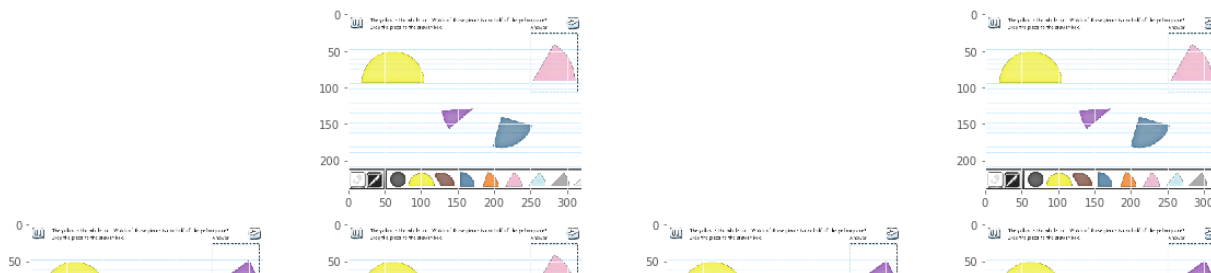Extracting tf-idf features ...
done in 0.333s.
Clustering with MiniBatchKMeans(batch_size=1000, compute_labels=True, ini
t='k-means++',
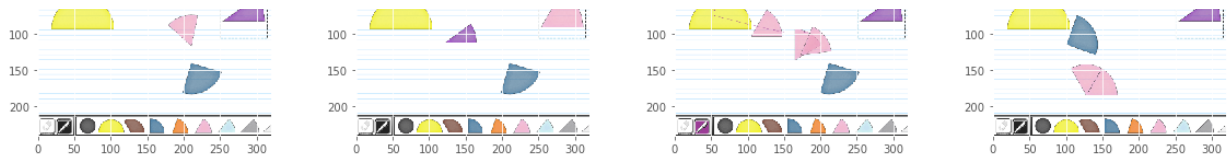
```
            init_size=1000, max_iter=100, max_no_improvement=10, n_clusters=1
0,
            n_init=1, random_state=42, reassignment_ratio=0.01, tol=0.0,
            verbose=0)
done in 0.065s
qual_id 9wRCzK1G7F.partb.qGGEQyiE_j has these clusters
5    1025
9     541
0     411
1     381
4     377
2     367
3     227
8     104
7      51
6      21
Name: cluster, dtype: int64
Cluster 5
http://woot_math_cub.s3.amazonaws.com/ss/74281/qGGEQyiE_j.1471477975701.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74281/qGGEQyiE_j.14714779757
01.png)
 could not read http://woot_math_cub.s3.amazonaws.com/ss/74281/qGGEQyiE_
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yiE_j.1471477975701.png)
http://woot_math_cub.s3.amazonaws.com/ss/76116/qGGEQyiE_j.1472664150970.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/76116/qGGEQyiE_j.14726641509
70.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/76139/qGGEQyiE_j.14728374512
50.png)
 could not read http://woot_math_cub.s3.amazonaws.com/ss/76139/qGGEQyiE_
j.1472837451250.png (http://woot_math_cub.s3.amazonaws.com/ss/76139/qGGEQ
yiE_j.1472837451250.png)
http://woot_math_cub.s3.amazonaws.com/ss/76139/qGGEQyiE_j.1472837721087.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/76139/qGGEQyiE_j.14728377210
87.png)
http://woot_math_cub.s3.amazonaws.com/ss/76126/qGGEQyiE_j.1472838529403.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/76126/qGGEQyiE_j.14728385294
03.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/76126/qGGEQyiE_j.14728385437
39.png)
http://woot_math_cub.s3.amazonaws.com/ss/77107/qGGEQyiE_j.1473263243576.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/77107/qGGEQyiE_j.14732632435
76.png)
http://woot_math_cub.s3.amazonaws.com/ss/77149/qGGEQyiE_j.1473265539528.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/77149/qGGEQyiE_j.14732655395
28.png)
```

Cluster 9
http://woot_math_cub.s3.amazonaws.com/ss/74240/qGGEQyiE_j.1470180209833.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74240/qGGEQyiE_j.14701802098
33.png)
http://woot_math_cub.s3.amazonaws.com/ss/74181/qGGEQyiE_j.1470166490992.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74181/qGGEQyiE_j.14701664909
92.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74322/qGGEQyiE_j.14702229068
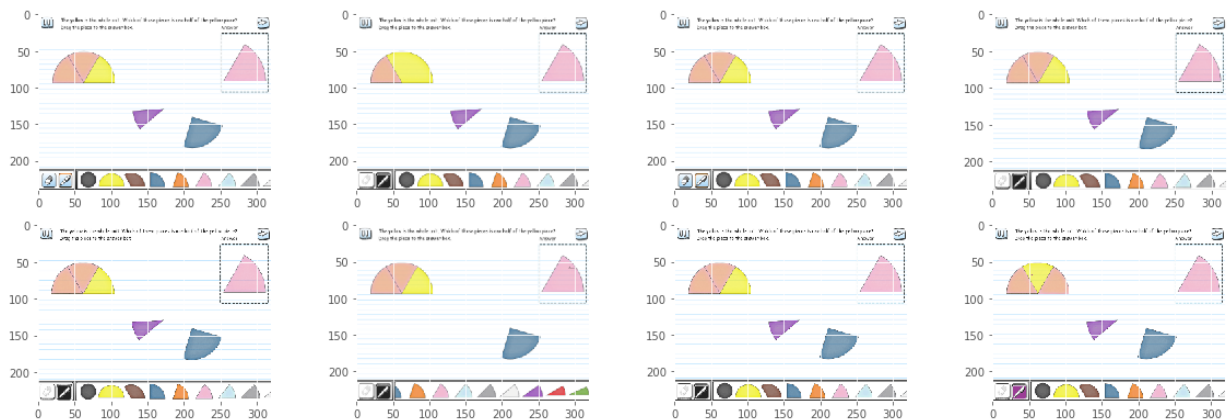76.png)
http://woot_math_cub.s3.amazonaws.com/ss/77562/qGGEQyiE_j.1472751460236.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/77562/qGGEQyiE_j.14727514602
36.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/76901/qGGEQyiE_j.14731683502
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17.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/77142/qGGEQyiE_j.14732569308
90.png)
http://woot_math_cub.s3.amazonaws.com/ss/77107/qGGEQyiE_j.1473263232265.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/77107/qGGEQyiE_j.14732632322
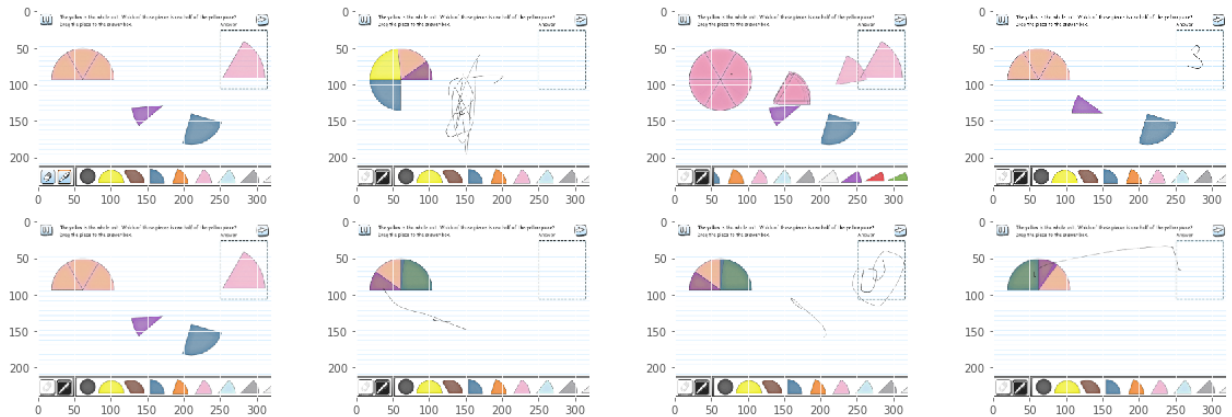65.png)

Cluster 0
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74238/qGGEQyiE_j.14701802172
70.png)
http://woot_math_cub.s3.amazonaws.com/ss/74320/qGGEQyiE_j.1470297938028.p
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44.png)
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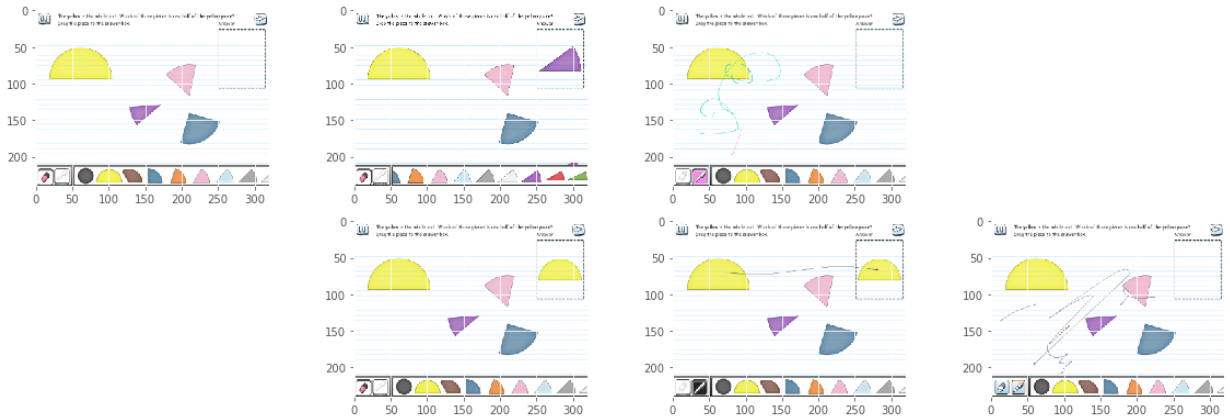ng (http://woot_math_cub.s3.amazonaws.com/ss/77684/qGGEQyiE_j.14733520898
14.png)

http://woot_math_cub.s3.amazonaws.com/ss/76375/qGGEQyiE_j.1473357967818.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/76375/qGGEQyiE_j.14733579678
18.png)
http://woot_math_cub.s3.amazonaws.com/ss/75863/qGGEQyiE_j.1473432400369.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/75863/qGGEQyiE_j.14734324003
69.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/76374/qGGEQyiE_j.14734445970
81.png)

Cluster 1
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ng (http://woot_math_cub.s3.amazonaws.com/ss/77592/qGGEQyiE_j.14728466642
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ng (http://woot_math_cub.s3.amazonaws.com/ss/77676/qGGEQyiE_j.14733520450
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j.1473352045056.png (http://woot_math_cub.s3.amazonaws.com/ss/77676/qGGEQ
yiE_j.1473352045056.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/76895/qGGEQyiE_j.14734260936
96.png)
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j.1473426093696.png (http://woot_math_cub.s3.amazonaws.com/ss/76895/qGGEQ
yiE_j.1473426093696.png)
http://woot_math_cub.s3.amazonaws.com/ss/74010/qGGEQyiE_j.1473810054496.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74010/qGGEQyiE_j.14738100544
96.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/78956/qGGEQyiE_j.14751812568
28.png)
http://woot_math_cub.s3.amazonaws.com/ss/84498/qGGEQyiE_j.1475250779636.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/84498/qGGEQyiE_j.14752507796

36.png)


```
Analysis 9 for qual_id kvig7fcCVc.partb.3y7UMHuR_i with 16876 samples
Session 0 txt  Arrange these fractions from least to greatest.
Drag each fraction into one of the boxes below.
Answer: 2/8,2/6,2/4
Extracting tf-idf features ...
done in 0.595s.
Clustering with MiniBatchKMeans(batch_size=1000, compute_labels=True, ini
t='k-means++',
        init_size=1000, max_iter=100, max_no_improvement=10, n_clusters=1
0,
        n_init=1, random_state=42, reassignment_ratio=0.01, tol=0.0,
        verbose=0)
done in 0.054s
qual_id kvig7fcCVc.partb.3y7UMHuR_i has these clusters
2     1507
0     1080
1      171
9       12
3        3
8        3
7        2
5        2
6        2
4        2
Name: cluster, dtype: int64
Cluster 2
http://woot_math_cub.s3.amazonaws.com/ss/72768/3y7UMHuR_i.1471270613856.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/72768/3y7UMHuR_i.14712706138
56.png)
http://woot_math_cub.s3.amazonaws.com/ss/74182/3y7UMHuR_i.1471393086814.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74182/3y7UMHuR_i.14713930868
14.png)
http://woot_math_cub.s3.amazonaws.com/ss/74184/3y7UMHuR_i.1471572968829.p
ng (http://woot_math_cub.s3.amazonaws.com/ss/74184/3y7UMHuR_i.14715729688
29.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/74992/3y7UMHuR_i.14720691974
97.png)
http://woot_math_cub.s3.amazonaws.com/ss/74323/3y7UMHuR_i.1472123241086.p
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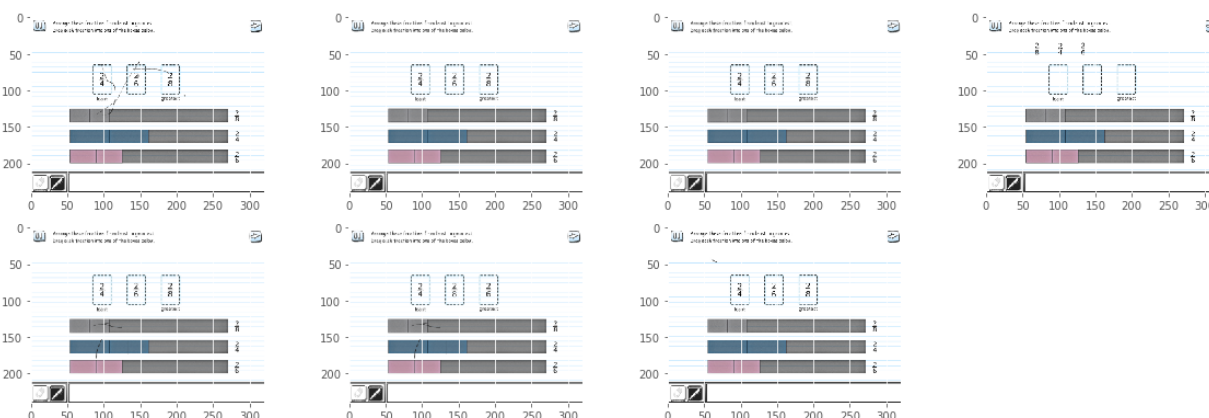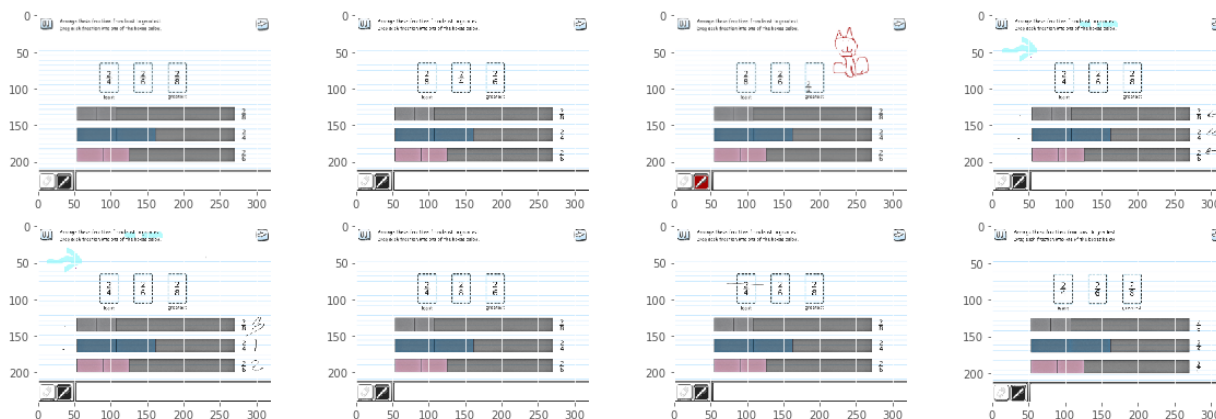
ng (http://woot_math_cub.s3.amazonaws.com/ss/74323/3y7UMHuR_i.14721232410
86.png)
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19.png)
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ng (http://woot_math_cub.s3.amazonaws.com/ss/76051/3y7UMHuR_i.14725579146
93.png)
http://woot_math_cub.s3.amazonaws.com/ss/76186/3y7UMHuR_i.1472658335046.p

ng (http://woot_math_cub.s3.amazonaws.com/ss/76186/3y7UMHuR_i.14726583350
46.png)
 could not read http://woot_math_cub.s3.amazonaws.com/ss/76186/3y7UMHuR_
i.1472658335046.png (http://woot_math_cub.s3.amazonaws.com/ss/76186/3y7UM
HuR_i.1472658335046.png)

Cluster 0
http://woot_math_cub.s3.amazonaws.com/ss/105862/3y7UMHuR_i.1486752896832.
png (http://woot_math_cub.s3.amazonaws.com/ss/105862/3y7UMHuR_i.148675289
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Cluster 1

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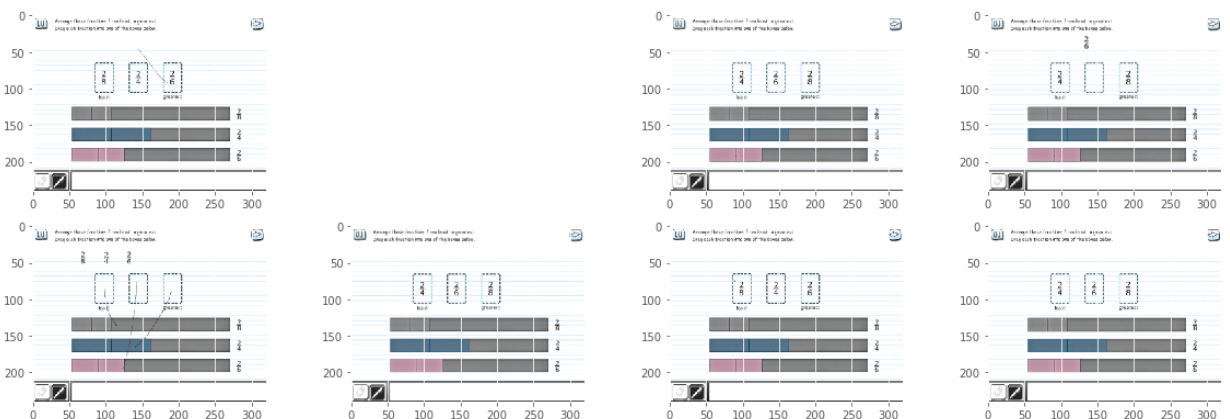72.png)
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