In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import statsmodels.api as sm
from statsmodels.formula.api import ols
from scipy import stats
from scipy.stats import chi2_contingency
%matplotlib inline
```

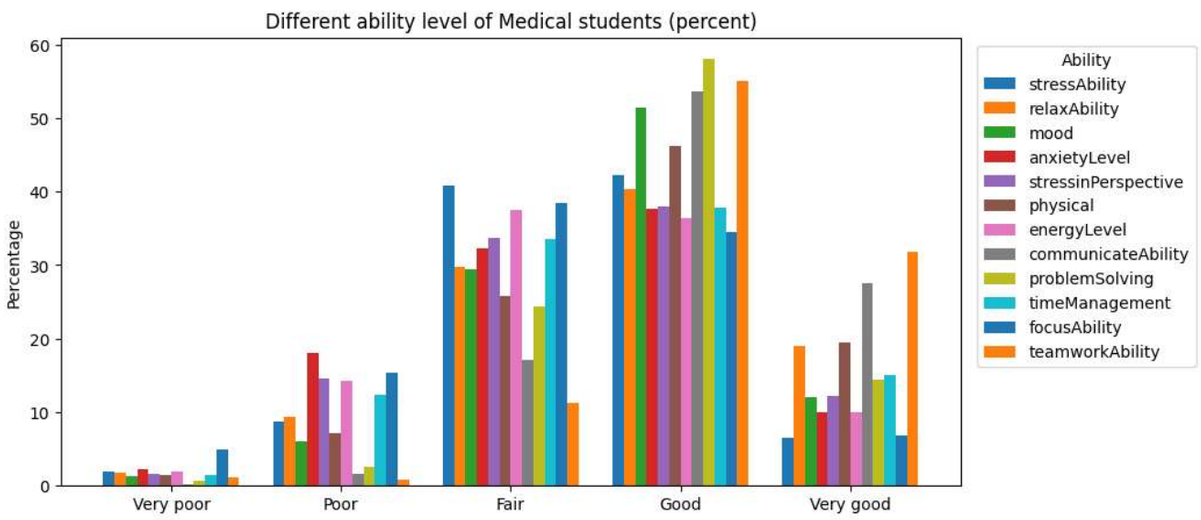
In [2]:
```
df = pd.read_stata('data.dta')
df.loc[(df['degree']==1) | (df['degree']==3) | (df['degree']==4),'background'] = 'Medical'
df.loc[(df['degree']==6),'background'] = 'Biochemistry'
```

In [3]:
```
df_med = df[(df['degree']==1) | (df['degree']==3) | (df['degree']==4)]
df_bio = df[df['degree']==6]
```

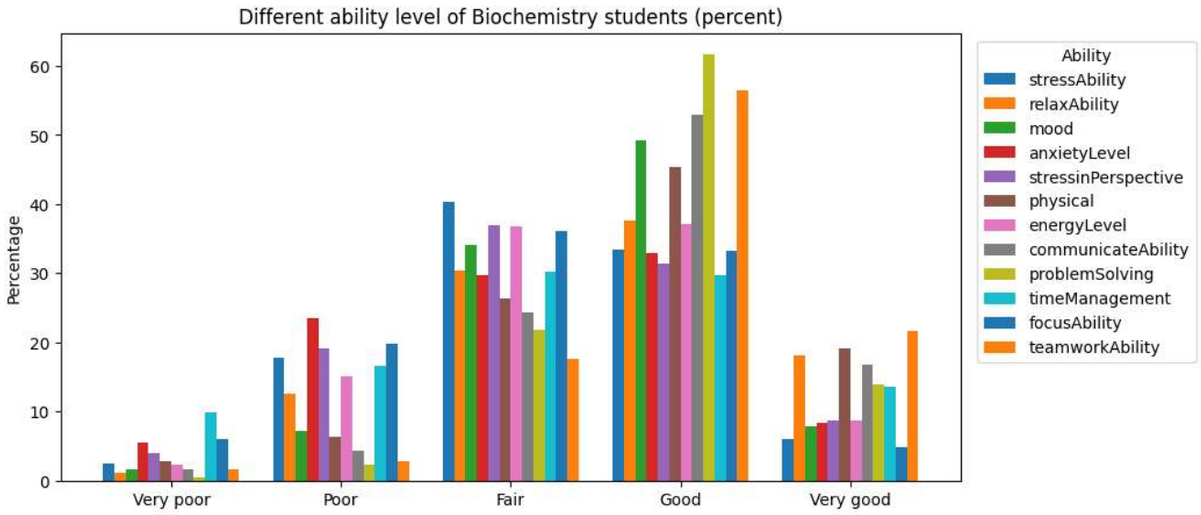
Abilities related to mental health of students

In [4]:
```
def gen_grouped_bar(data, columns, title=' ', xlab=' ', legend=' ', legend_name=[]):
    value_counts = data[columns].apply(pd.value_counts)
    percentages = (value_counts / value_counts.sum()) * 100

    ax = percentages.plot(kind='bar', legend=True, figsize=(10, 5), width=.8)
    plt.ylabel('Percentage')
    plt.xlabel(xlab)
    plt.title(title)
    plt.xticks(rotation=0)
    plt.legend(title=legend, loc='upper center', labels=legend_name, bbox_to_anchor=(1.14, 1))
    plt.show()
```

In [5]:
```
gen_grouped_bar(
    df_med, df.columns[2:14],
    title='Different ability level of Medical students (percent)',
    legend='Ability',
    legend_name = df.columns[2:14])
```

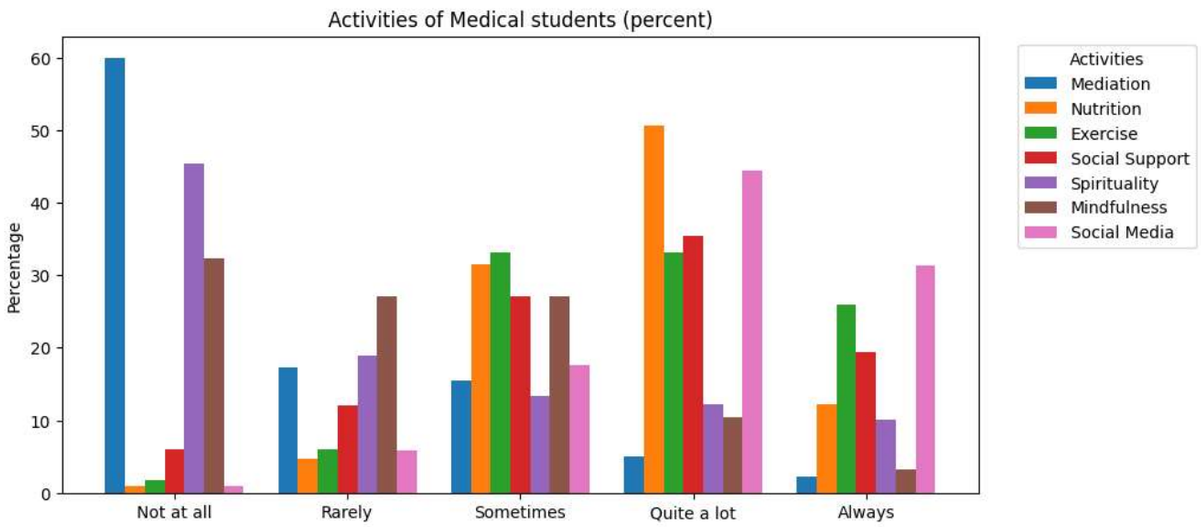


In [6]:
```
gen_grouped_bar(
    df_bio, df.columns[2:14],
    title='Different ability level of Biochemistry students (percent)',
    legend='Ability',
    legend_name = df.columns[2:14])
```

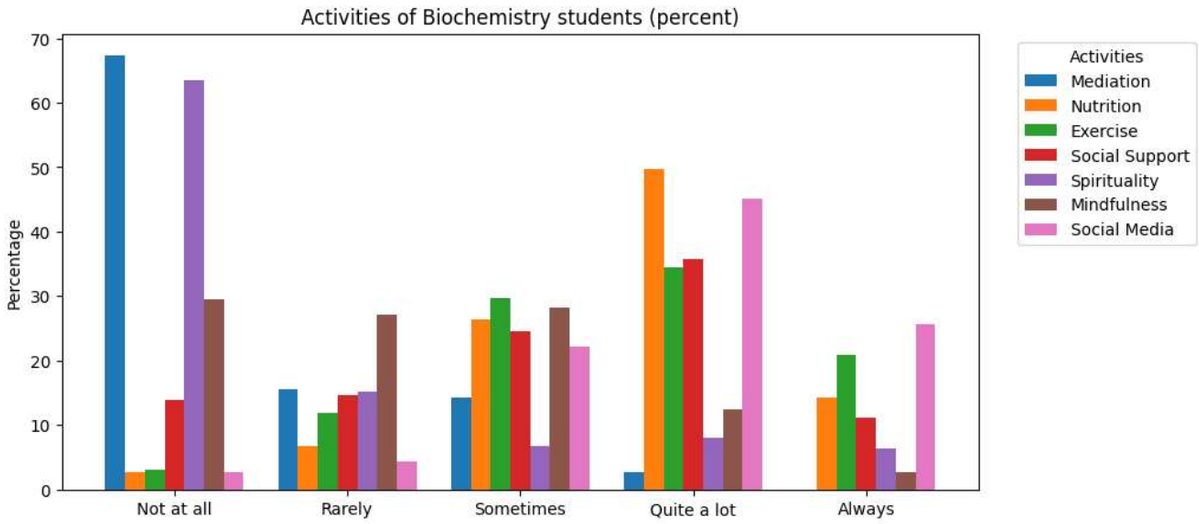


Activities of students in leisure time

In [7]:
```
legend_names = ['Mediation', 'Nutrition', 'Exercise', 'Social Support',
                'Spirituality', 'Mindfulness', 'Social Media']
gen_grouped_bar(
    df_med, df.columns[14:21],
    title='Activities of Medical students (percent)',
    legend='Activities',
    legend_name = legend_names)
```



In [8]:
```
gen_grouped_bar(
    df_bio, df.columns[14:21],
    title='Activities of Biochemistry students (percent)',
    legend='Activities',
    legend_name = legend_names)
```

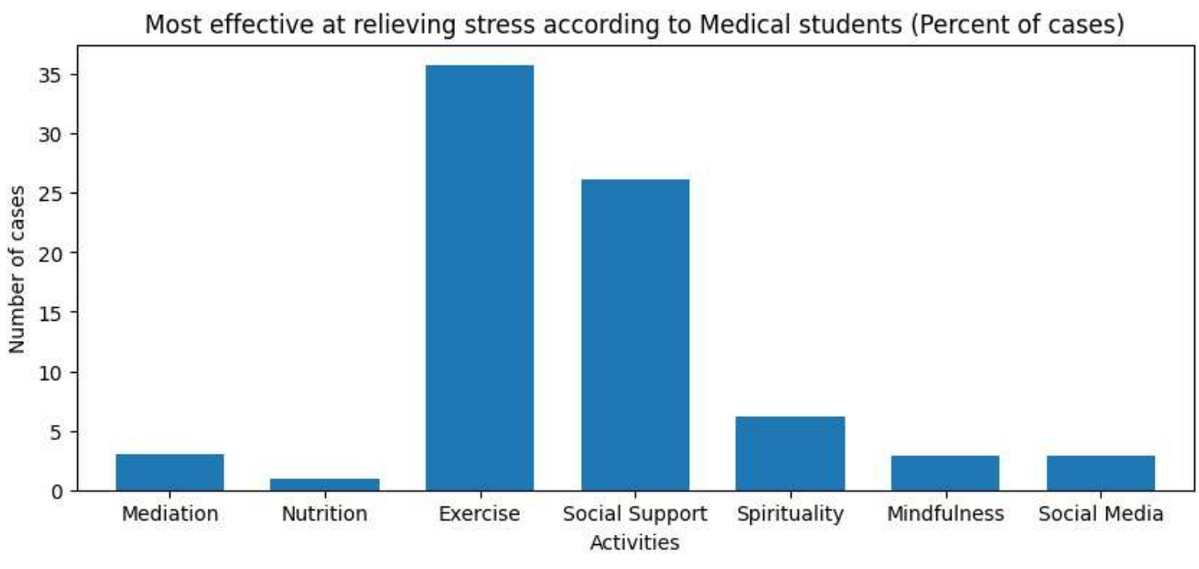


Most effective stress relieving activities according to students

In [9]:
```
c_names = ['Mediation', 'Nutrition', 'Exercise', 'Social Support',
           'Spirituality', 'Mindfulness', 'Social Media']
df_mr = df_med[df.columns[22:29]]
df_dummies = pd.get_dummies(df_mr, columns=df.columns[22:29])
df_dummies.columns = c_names
response_counts = df_dummies.sum()
percentage = response_counts/np.shape(df_med)[0] * 100
percentage.round(3)
```

Out[9]:
```
Mediation          3.026
Nutrition          0.908
Exercise          35.703
Social Support    26.172
Spirituality       6.203
Mindfulness        2.874
Social Media       2.874
dtype: float64
```

In [10]:
```
percentage.plot(kind='bar', figsize=(10, 4), width=.7)
plt.xticks(rotation=0)
plt.xlabel('Activities')
plt.ylabel('Number of cases')
plt.title('Most effective at relieving stress according to Medical students (Percent of cases)')
plt.show()
```

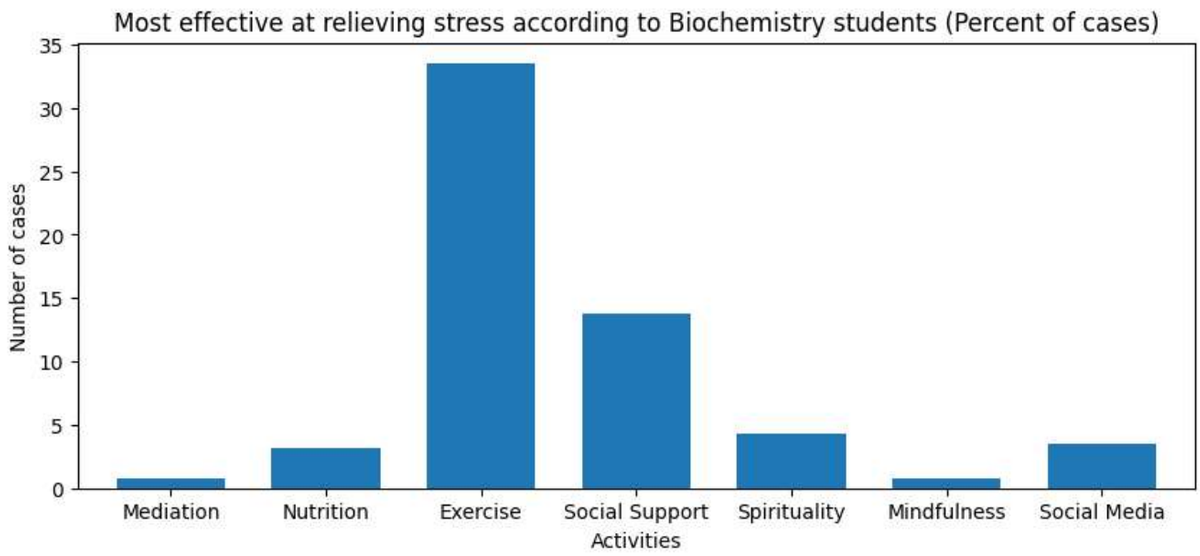


Most of the Medical students thinks that 'Exercise' (35.70%) and 'Social Support Activities' (26.17%) are effective on stress relieve.

In [11]:
```
df_mr = df_bio[df.columns[22:29]]
df_dummies = pd.get_dummies(df_mr, columns=df.columns[22:29])
df_dummies.columns = c_names
response_counts = df_dummies.sum()
percentage = response_counts/np.shape(df_bio)[0] * 100
percentage.round(3)
```

Out[11]:
```
Mediation          0.787
Nutrition          3.150
Exercise          33.465
Social Support    13.780
Spirituality       4.331
Mindfulness        0.787
Social Media       3.543
dtype: float64
```

In [12]:
```
percentage.plot(kind='bar', figsize=(10, 4), width=.7)
plt.xticks(rotation=0)
plt.xlabel('Activities')
plt.ylabel('Number of cases')
plt.title('Most effective at relieving stress according to Biochemistry students (Percent of cases)')
plt.show()
```



Most of the Medical students thinks that 'Exercise' (33.46%) and 'Social Support Activities' (13.78%) are effective on stress relieve.

Comparison: (Social Media)

Only 2.87% of Medical students and 3.54% Biochemistry students thinks that 'Social Media' effective on stress relieve. This number is quite small than 'Exercise' and 'Social Support Activities' in both of the groups.

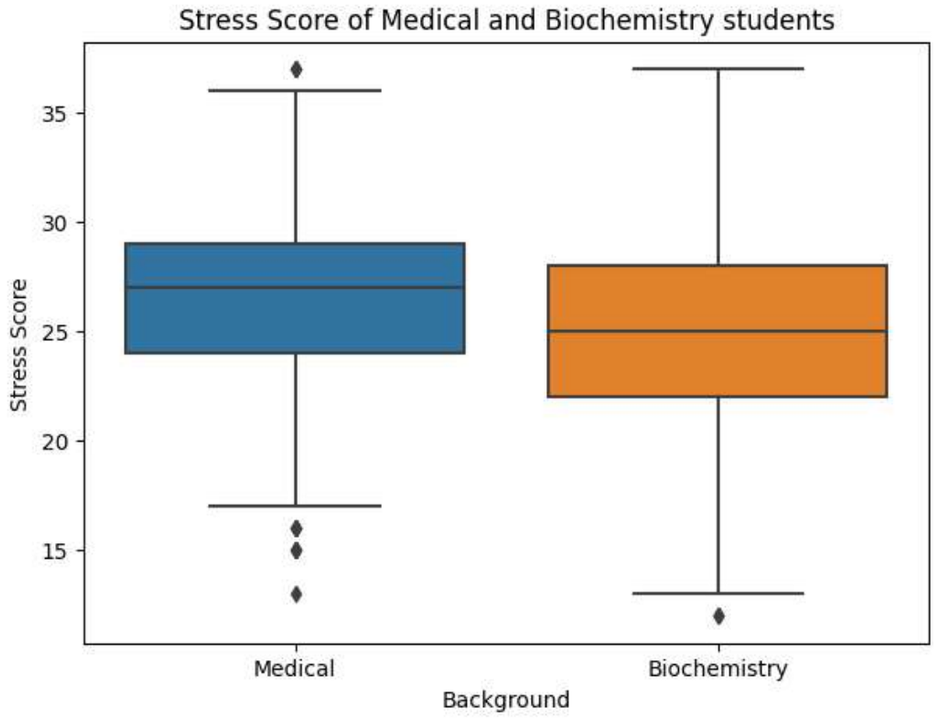
Analysing students stress score

By degree

In [13]:
```
df['stressScore'].describe().round(2)
```

Out[13]:
```
count    876.00
mean      25.96
std        4.34
min       12.00
25%       23.00
50%       26.00
75%       29.00
max       37.00
Name: stressScore, dtype: float64
```

In [14]:
```
plt.figure(figsize=(7, 5))
sns.boxplot(data=df, x='background', y='stressScore')
plt.xlabel('Background')
plt.ylabel('Stress Score')
plt.title('Stress Score of Medical and Biochemistry students')
plt.show()
```



We suspect a difference of score in the graph between tow cohort. We will do a two independent samples t-test to clarify the doubt.

Hypothesis testing of mean difference of score between Medical and Biochemistry students

$H_0 : \mu_{Med} = \mu_{Bio}$

$H_1 : \mu_{Med} \neq \mu_{Bio}$

In [15]:
```
med_score = df.loc[df["background"]=="Medical", 'stressScore']
med_score = med_score[~np.isnan(med_score)]
med_score.describe().round(2)
```

Out[15]:
```
count    647.00
mean      26.44
std        4.14
min       13.00
25%       24.00
50%       27.00
75%       29.00
max       37.00
Name: stressScore, dtype: float64
```

In [16]:
```
bio_score = df.loc[df["background"]=="Biochemistry", 'stressScore']
bio_score = bio_score[~np.isnan(bio_score)]
bio_score.describe().round(2)
```

Out[16]:
```
count    229.00
mean      24.62
std        4.60
min       12.00
25%       22.00
50%       25.00
75%       28.00
max       37.00
Name: stressScore, dtype: float64
```

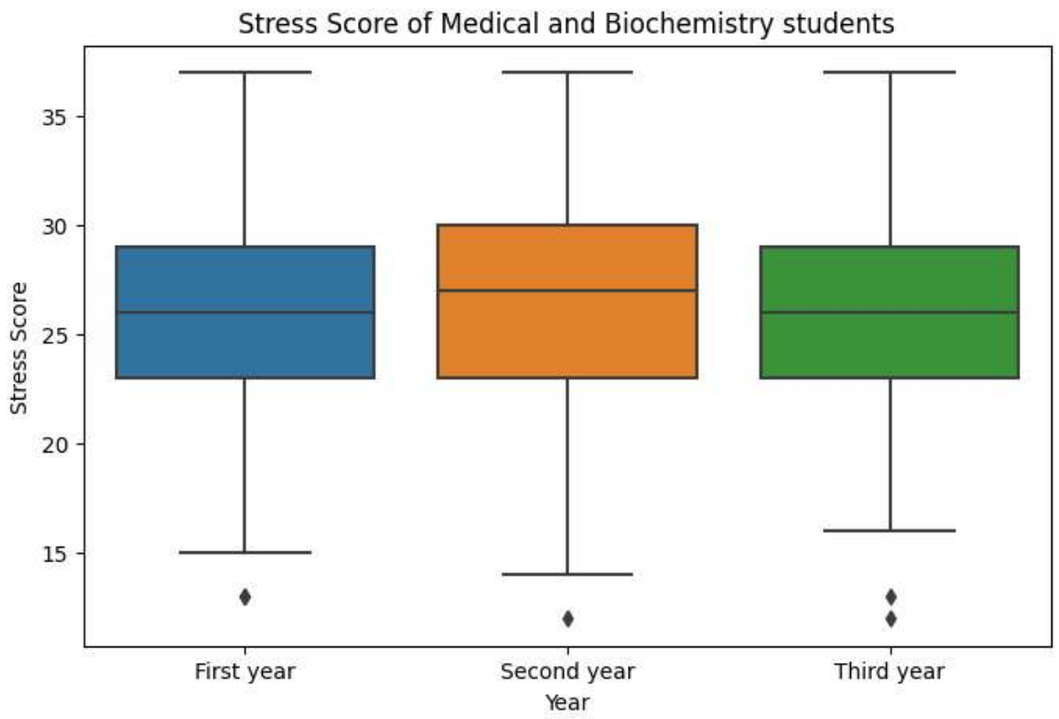
In [17]:
```
t_statistic, p_value = stats.ttest_ind(med_score, bio_score)

print("t-Statistic:", t_statistic.round(3))
print("P-Value:", p_value.round(11))

alpha = 0.05
if p_value < alpha:
    print("Reject the null hypothesis: There is a significant difference between the samples.")
else:
    print("Fail to reject the null hypothesis: There is no significant difference between the samples.
```

```
t-Statistic: 5.565
P-Value: 3.496e-08
Reject the null hypothesis: There is a significant difference between the samples.
```

So, it is now clear that Medical students have significantly higher score and Biochemistry students have less.

By year

In [18]:
```
plt.figure(figsize=(8, 5))
sns.boxplot(data=df, x='year', y='stressScore')
plt.xlabel('Year')
plt.ylabel('Stress Score')
plt.title('Stress Score of Medical and Biochemistry students')
plt.show()
```



Mean stress score of different year student may equal. We can predict this by the graph shown above. Let's check if the prediction is right.

Are mean stress scores of different year student same?

$H_0 : \mu_1 = \mu_2 = \mu_3$

$H_1 : \mu_i \neq \mu_j$; at least for one $i \neq j$

In [19]:
```
formula = 'stressScore ~ year'
model = ols(formula, data=df).fit()
anova_table = sm.stats.anova_lm(model, typ=2)
anova_table
```

Out[19]:

	sum_sq	df	F	PR(>F)
year	18.665372	2.0	0.494706	0.609921
Residual	16469.237596	873.0	NaN	NaN

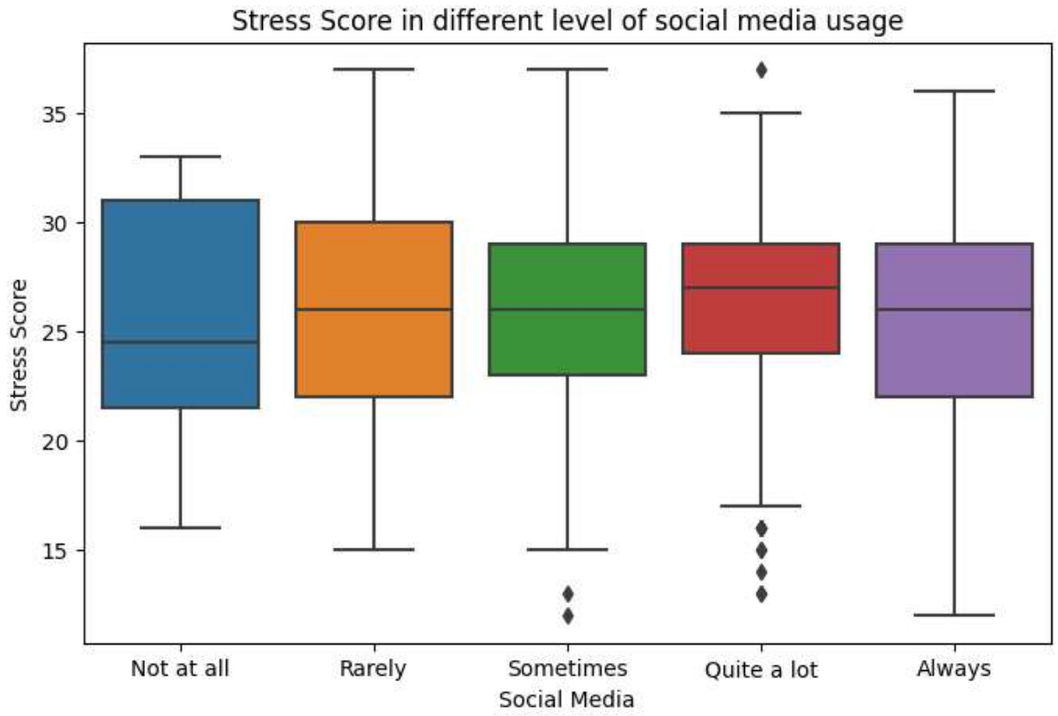
```
               coef    std err          t      P>|t|      [0.025      0.975]
Intercept     25.8731      0.217    119.435      0.000      25.448      26.298
Second year    0.3374      0.360      0.937      0.349      -0.369       1.044
```

```
Third year      0.0130      0.352      0.037     0.970    -0.677    0.703
```

Here, p-value>.05. So we may not reject the H_0. So, means of score are equal in each year of students.

Relation between stress score and social media usage

In [20]:
```
plt.figure(figsize=(8, 5))
sns.boxplot(data=df, x='socialMedia', y='stressScore')
plt.xlabel('Social Media')
plt.ylabel('Stress Score')
plt.title('Stress Score in different level of social media usage')
plt.show()
```



$H_0 : \mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$

$H_1 : \mu_i \neq \mu_j$; at least for one $i \neq j$

In [21]:
```
formula = 'stressScore ~ socialMedia'
model = ols(formula, data=df).fit()
anova_table = sm.stats.anova_lm(model, typ=2)
anova_table
```

Out[21]:

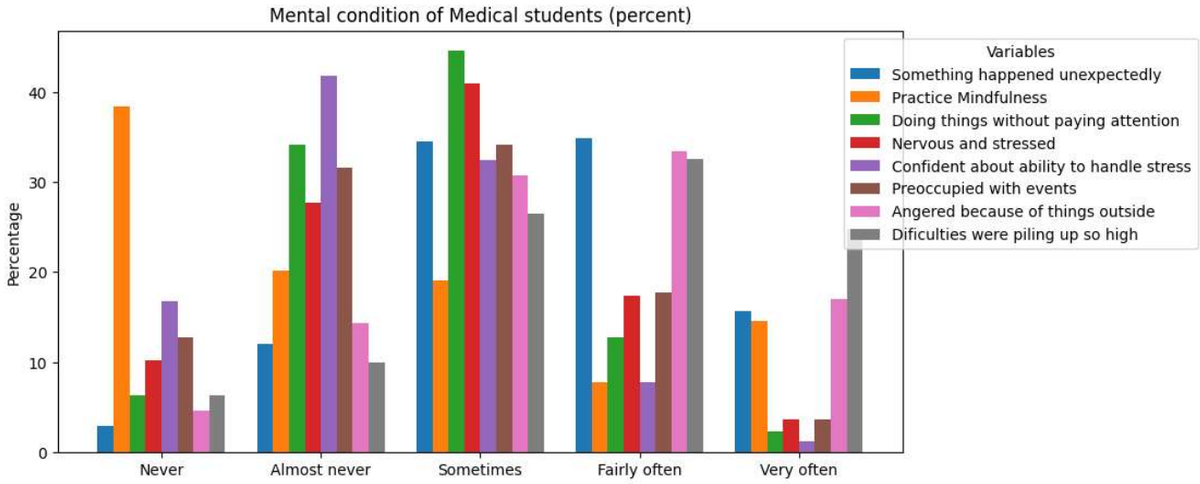
	sum_sq	df	F	PR(>F)
socialMedia	70.073632	4.0	0.929572	0.446003
Residual	16376.896620	869.0	NaN	NaN

```
               coef     std err     t        P>|t|    [0.025    0.975]
Intercept     25.7000    1.373    18.721     0.000    23.006    28.394
Rarely         0.3889    1.518     0.256     0.798    -2.590     3.368
Sometimes      0.1963    1.414     0.139     0.890    -2.579     2.972
Quite a lot    0.5430    1.390     0.391     0.696    -2.186     3.272
Always        -0.1129    1.399    -0.081     0.936    -2.858     2.632
```

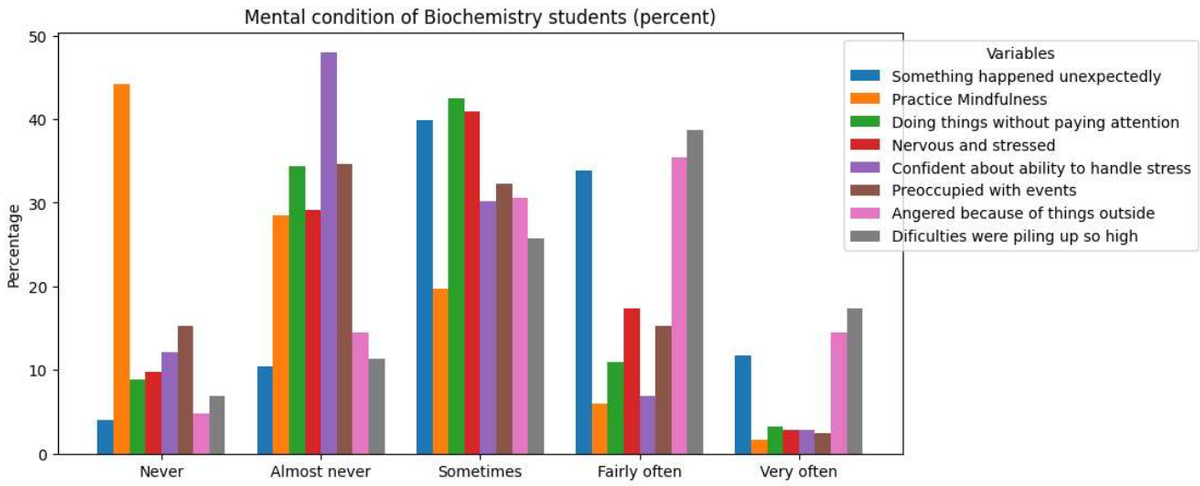
Here, p-value>.05. So we may not reject the H_0. So, means of score are equal in each level of social media usage. So, it is unnessecary to check individual groups. (eg: Medical, Biochemistry)

Last month mental condition

In [22]:
```
legend_names = ['Something happened unexpectedly', 'Practice Mindfulness',
       'Doing things without paying attention', 'Nervous and stressed',
       'Confident about ability to handle stress', 'Preoccupied with events',
       'Angered because of things outside', 'Dificulties were piling up so high']

gen_grouped_bar(
    df_med, df.columns[97:105],
    title='Mental condition of Medical students (percent)',
    legend='Variables',
    legend_name = legend_names)
```



In [23]:
```
legend_names = ['Something happened unexpectedly', 'Practice Mindfulness',
       'Doing things without paying attention', 'Nervous and stressed',
       'Confident about ability to handle stress', 'Preoccupied with events',
       'Angered because of things outside', 'Dificulties were piling up so high']

gen_grouped_bar(
    df_bio, df.columns[97:105],
    title='Mental condition of Biochemistry students (percent)',
    legend='Variables',
    legend_name = legend_names)
```



Relationship between Social Media and Stress of Medical students

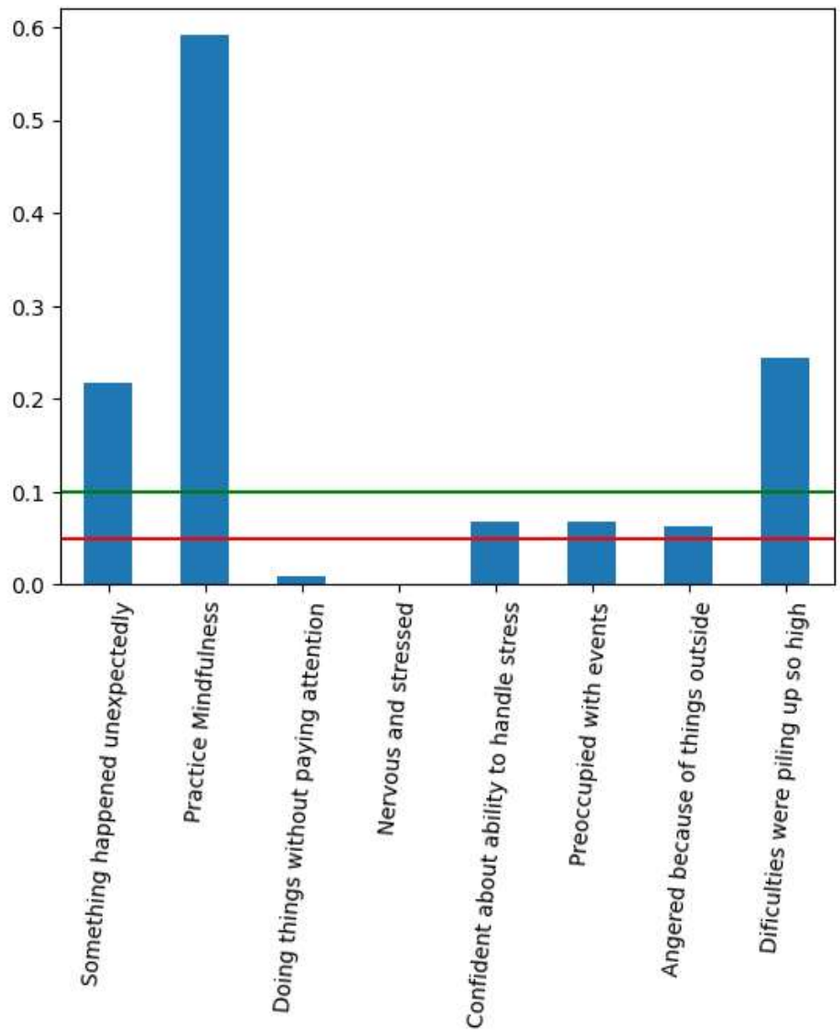
In [24]:
```
columns_to_analyze = [
    'something_happened_unexpectedly', 'practice_Mindfulness',
    'doing_things_without_paying_atte', 'nervous_and_stressed',
    'confident_about_ability_to_handl', 'preoccupied_with_events',
    'angered_because_of_things_outsid', 'dificulties_were_piling_up_so_hi'
]
c_names = ['Something happened unexpectedly', 'Practice Mindfulness',
       'Doing things without paying attention', 'Nervous and stressed',
       'Confident about ability to handle stress', 'Preoccupied with events',
       'Angered because of things outside', 'Dificulties were piling up so high']
stat = {'ChiSQ': [], "p-value": []}

for column in columns_to_analyze:
    contingency_table = pd.crosstab(df_med['socialMedia'], df_med[column])

    chi2, p, _, _ = chi2_contingency(contingency_table)

    stat['ChiSQ'].append(chi2)
    stat['p-value'].append(p)


stat = pd.DataFrame(stat, index=c_names)
stat['alpha=5%'] = stat['p-value']<0.05
stat['alpha=10%'] = stat['p-value']<0.1

stat
```

Out[24]:

	ChiSQ	p-value	alpha=5%	alpha=10%
Something happened unexpectedly	20.083040	0.216504	False	False
Practice Mindfulness	14.099832	0.591277	False	False
Doing things without paying attention	32.249270	0.009278	True	True
Nervous and stressed	42.368355	0.000348	True	True
Confident about ability to handle stress	25.103563	0.068020	False	True
Preoccupied with events	25.118775	0.067759	False	True
Angered because of things outside	25.453792	0.062215	False	True
Dificulties were piling up so high	19.495242	0.243819	False	False

```
True = Associated with social media
False = Not associated with social media
```

In [25]:
```
stat['p-value'].plot(kind='bar')
plt.axhline(y=.05, color='r', label='Horizontal Line at y=15')
plt.axhline(y=.1, color='g', label='Horizontal Line at y=15')
plt.xticks(rotation=85)
plt.show()
```

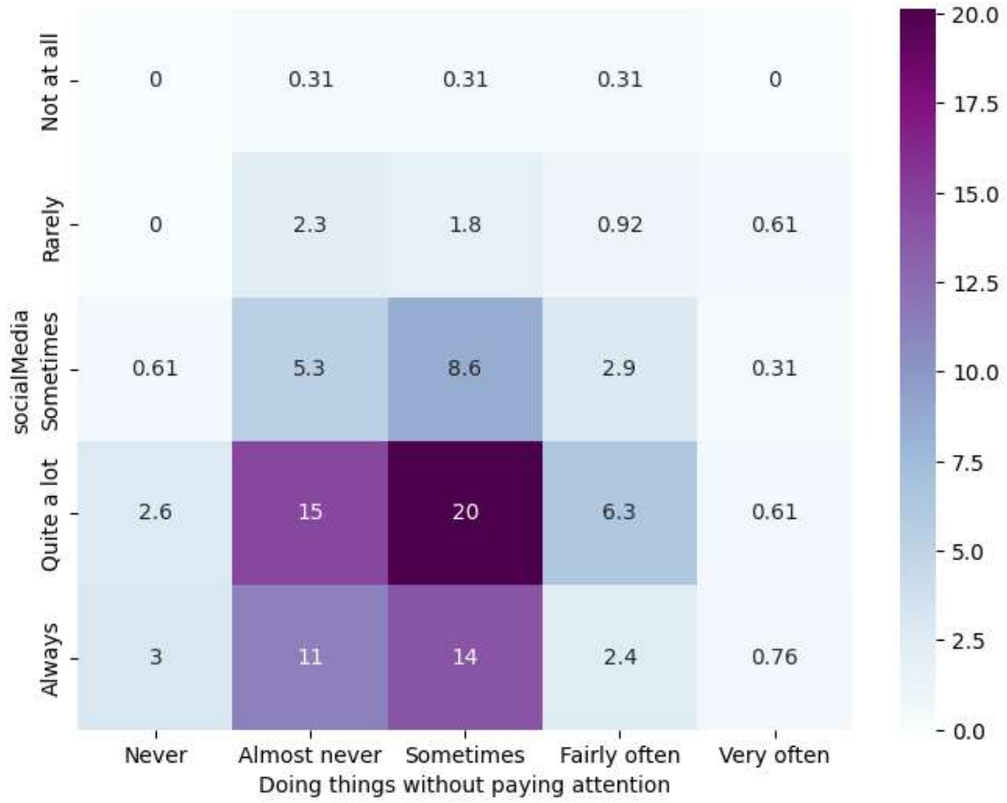


Heatmap plot for significant pairs (Percent of cases)

From the plot above we can see 'Social Media' usage of Medical students is associated with 'Doing things without paying attention' and 'Nervous and stressed'. Let's visualise the association with the help of heatmap plot.

In [26]:
```
def gen_heatmap(data, factor1, factor2):
    columns_to_analyze = [
        'something_happened_unexpectedly', 'practice_Mindfulness',
        'doing_things_without_paying_atte', 'nervous_and_stressed',
        'confident_about_ability_to_handl', 'preoccupied_with_events',
        'angered_because_of_things_outsid', 'dificulties_were_piling_up_so_hi']
    c_names = [
        'Something happened unexpectedly', 'Practice Mindfulness',
        'Doing things without paying attention', 'Nervous and stressed',
        'Confident about ability to handle stress', 'Preoccupied with events',
        'Angered because of things outside', 'Dificulties were piling up so high']
    pivot_table = pd.crosstab(data[factor1], data[factor2])
    total_count = pivot_table.values.sum()
    overall_percentage = (pivot_table / total_count * 100).round(2)
    plt.figure(figsize=(8, 6))
    sns.heatmap(overall_percentage, annot=True, cmap='BuPu')
    plt.xlabel(c_names[columns_to_analyze.index(factor2)])
    plt.ylabel(factor1)
    plt.show()
```

In [27]:
```
gen_heatmap(df_med, 'socialMedia', 'doing_things_without_paying_atte')
```



In [28]:
```
gen_heatmap(df_med, 'socialMedia', 'nervous_and_stressed')
```

Relationship between Social Media and Stress of Biochemistry students

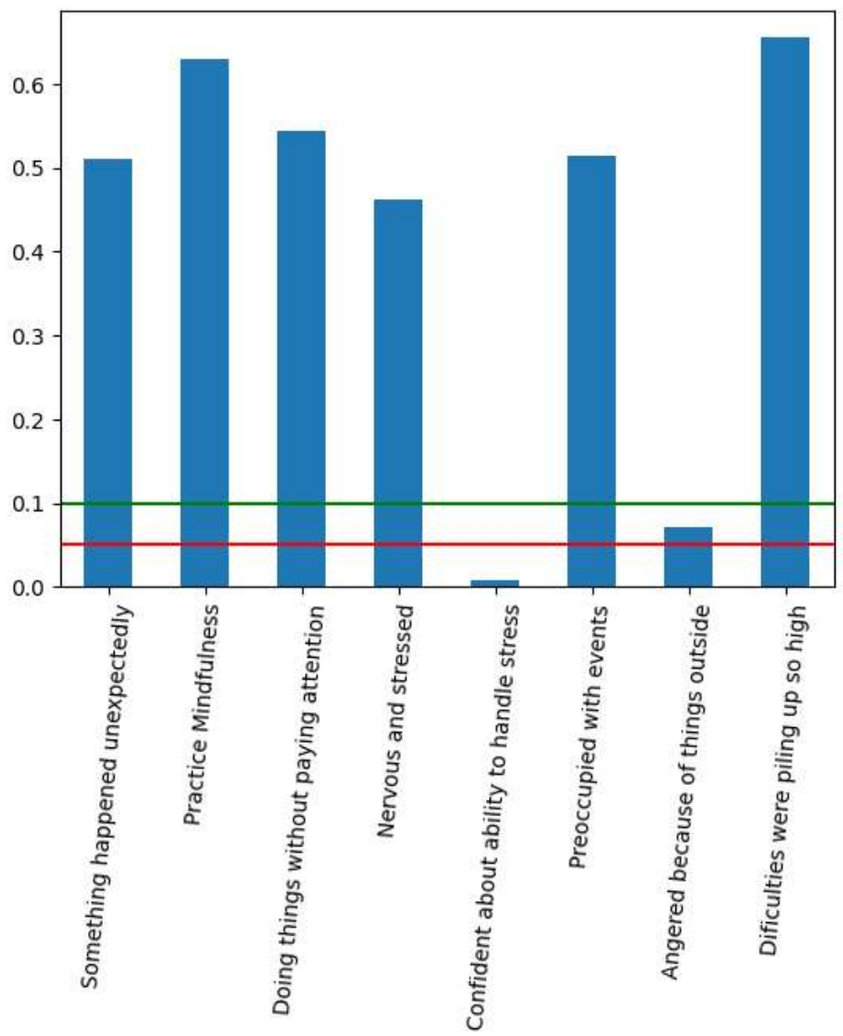
In [29]:
```
stat = {'ChiSQ': [], "p-value": []}

for column in columns_to_analyze:
    contingency_table = pd.crosstab(df_bio['socialMedia'], df_bio[column])

    chi2, p, _, _ = chi2_contingency(contingency_table)

    stat['ChiSQ'].append(chi2)
    stat['p-value'].append(p)


stat = pd.DataFrame(stat, index=c_names)
stat['alpha=5%'] = stat['p-value']<0.05
stat['alpha=10%'] = stat['p-value']<0.1

stat
```

Out[29]:

	ChiSQ	p-value	alpha=5%	alpha=10%
Something happened unexpectedly	15.203546	0.509784	False	False
Practice Mindfulness	13.593694	0.628954	False	False
Doing things without paying attention	14.727804	0.544658	False	False
Nervous and stressed	15.874324	0.461766	False	False
Confident about ability to handle stress	32.783452	0.007894	True	True
Preoccupied with events	15.138349	0.514530	False	False
Angered because of things outside	24.910255	0.071423	False	True
Dificulties were piling up so high	13.243192	0.654900	False	False

```
True = Associated with social media
False = Not associated with social media
```

In [30]:
```
stat['p-value'].plot(kind='bar')
plt.axhline(y=.05, color='r', label='Horizontal Line at y=15')
plt.axhline(y=.1, color='g', label='Horizontal Line at y=15')
plt.xticks(rotation=85)
plt.show()
```



Heatmap plot for significant pairs

From the plot above we can see 'Social Media' usage of Biochemistry students is associated with 'Doing things without paying attention' and 'Nervous and stressed'. Let's visualise the association with the help of heatmap plot.

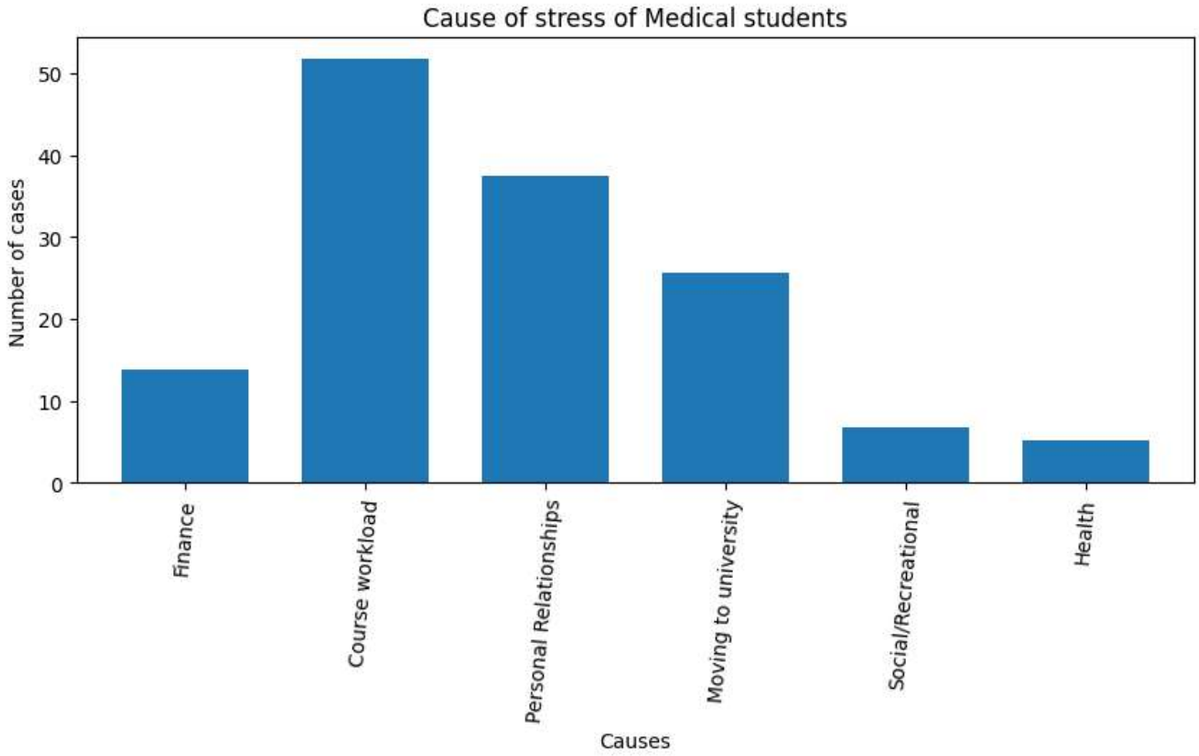
In [31]:
```
gen_heatmap(df_bio, 'socialMedia', 'confident_about_ability_to_handl')
```

Cause of stress

In [32]:
```
c_names = ['Finance', 'Course workload', 'Personal Relationships', 'Moving to university', 'Social/Rec

df_mr = df_med[df.columns[107:113]]
df_dummies = pd.get_dummies(df_mr, columns=df.columns[107:113])
df_dummies.columns = c_names
response_counts = df_dummies.sum()
percentage = response_counts/np.shape(df_med)[0] * 100
percentage.round(3)
```

Out[32]:
```
Finance                  13.767
Course workload          51.740
Personal Relationships   37.519
Moving to university     25.567
Social/Recreational       6.808
Health                    5.144
dtype: float64
```

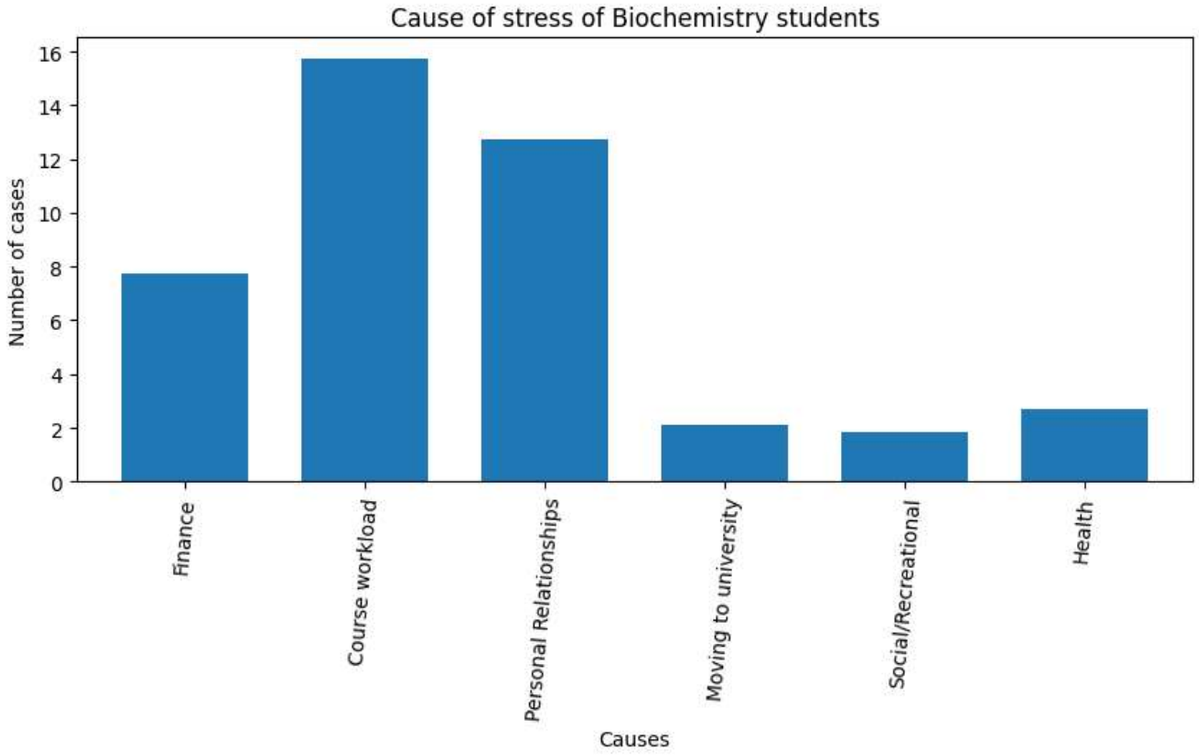
In [33]:
```
percentage.plot(kind='bar', figsize=(10, 4), width=.7)
plt.xticks(rotation=0)
plt.xlabel('Causes')
plt.ylabel('Number of cases')
plt.xticks(rotation=85)
plt.title('Cause of stress of Medical students')
plt.show()
```



In [34]:
```
c_names = ['Finance', 'Course workload', 'Personal Relationships', 'Moving to university', 'Social/Rec

df_mr = df_bio[df.columns[107:113]]
df_dummies = pd.get_dummies(df_mr, columns=df.columns[107:113])
df_dummies.columns = c_names
response_counts = df_dummies.sum()
percentage = response_counts/np.shape(df_med)[0] * 100
percentage.round(3)
```

Out[34]:
```
Finance                   7.716
Course workload          15.734
Personal Relationships   12.708
Moving to university      2.118
Social/Recreational       1.815
Health                    2.723
dtype: float64
```

In [35]:
```
percentage.plot(kind='bar', figsize=(10, 4), width=.7)
plt.xticks(rotation=0)
plt.xlabel('Causes')
plt.ylabel('Number of cases')
plt.xticks(rotation=85)
plt.title('Cause of stress of Biochemistry students')
plt.show()
```



In conclusion we can say. Social media may not be a cause to reduce stress. Also Exercise can be a good factor of reducing stress.

Relationship between Exercise and Stress of Medical students

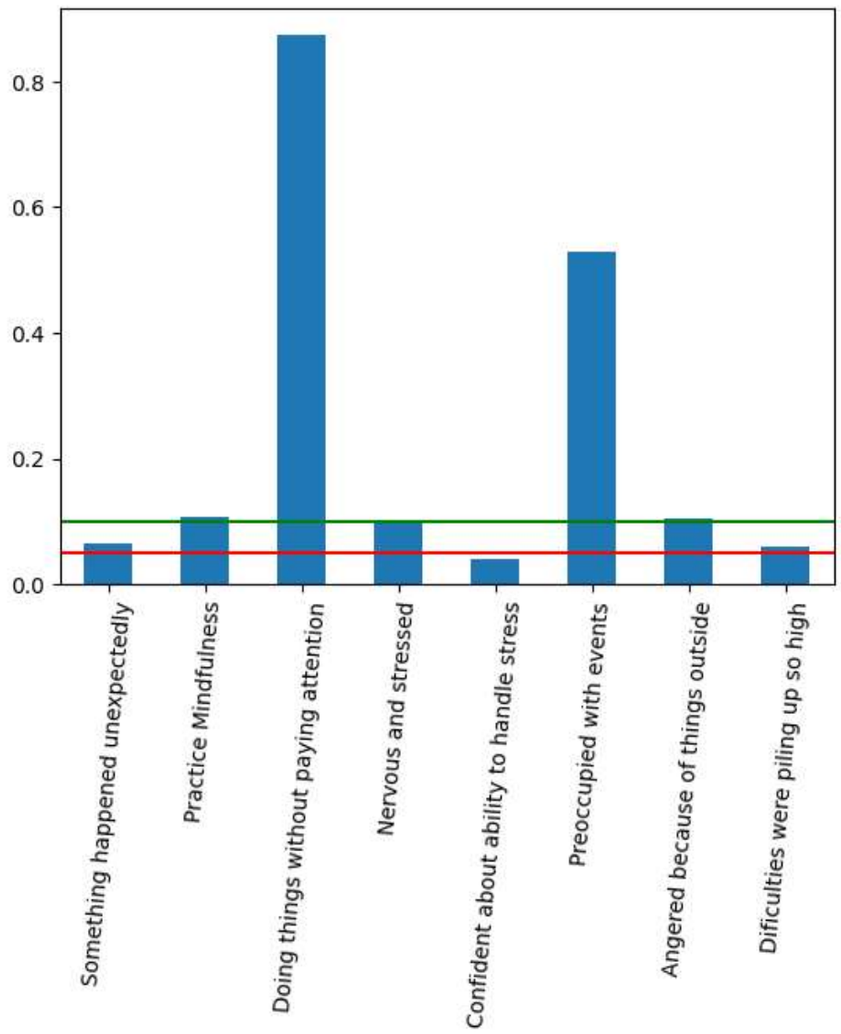
In [36]:
```
columns_to_analyze = [
    'something_happened_unexpectedly', 'practice_Mindfulness',
    'doing_things_without_paying_atte', 'nervous_and_stressed',
    'confident_about_ability_to_handl', 'preoccupied_with_events',
    'angered_because_of_things_outsid', 'dificulties_were_piling_up_so_hi'
]
c_names = ['Something happened unexpectedly', 'Practice Mindfulness',
       'Doing things without paying attention', 'Nervous and stressed',
       'Confident about ability to handle stress', 'Preoccupied with events',
       'Angered because of things outside', 'Dificulties were piling up so high']
stat = {'ChiSQ': [], "p-value": []}

for column in columns_to_analyze:
    contingency_table = pd.crosstab(df_med['exercise'], df_med[column])

    chi2, p, _, _ = chi2_contingency(contingency_table)

    stat['ChiSQ'].append(chi2)
    stat['p-value'].append(p)


stat = pd.DataFrame(stat, index=c_names)
stat['alpha=5%'] = stat['p-value']<0.05
stat['alpha=10%'] = stat['p-value']<0.1

stat
```

Out[36]:

	ChiSQ	p-value	alpha=5%	alpha=10%
Something happened unexpectedly	25.229857	0.065874	False	True
Practice Mindfulness	23.191835	0.108702	False	False
Doing things without paying attention	9.877051	0.872970	False	False
Nervous and stressed	23.572497	0.099266	False	True
Confident about ability to handle stress	27.135178	0.040005	True	True
Preoccupied with events	14.923523	0.530247	False	False
Angered because of things outside	23.347316	0.104761	False	False
Dificulties were piling up so high	25.538748	0.060874	False	True

```
True = Associated with social media
False = Not associated with social media
```

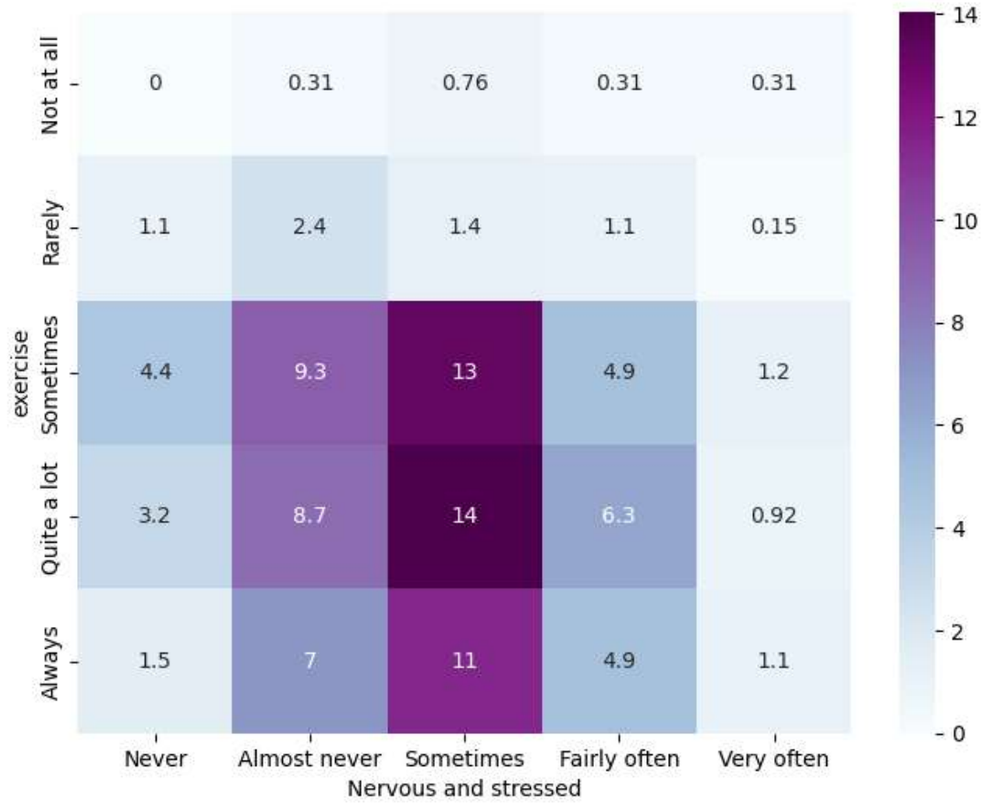
In [37]:
```
stat['p-value'].plot(kind='bar')
plt.axhline(y=.05, color='r', label='Horizontal Line at y=15')
plt.axhline(y=.1, color='g', label='Horizontal Line at y=15')
plt.xticks(rotation=85)
plt.show()
```



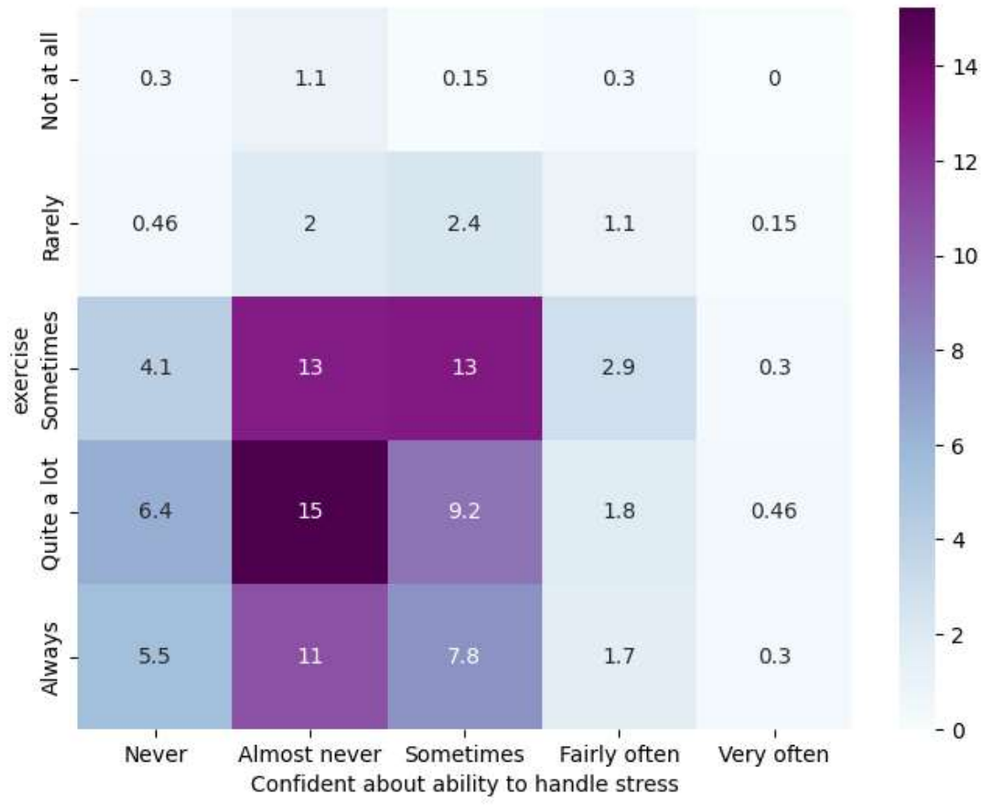
For 10% tollarence 'Exercise' is associated with 'Something happened unexpectedly', 'Nervous and stressed', 'Confident about ability to handle stress' and 'Dificulties were piling up so high' Let's have a look on heatmap.

In [38]:
```
gen_heatmap(df_med, 'exercise', 'something_happened_unexpectedly')
```

In [39]:
```
gen_heatmap(df_med, 'exercise', 'nervous_and_stressed')
```



In [40]:
```
gen_heatmap(df_med, 'exercise', 'confident_about_ability_to_handl')
```



In [41]:
```
gen_heatmap(df_med, 'exercise', 'dificulties_were_piling_up_so_hi')
```

Relationship between Exercise and Stress of Biochemistry students

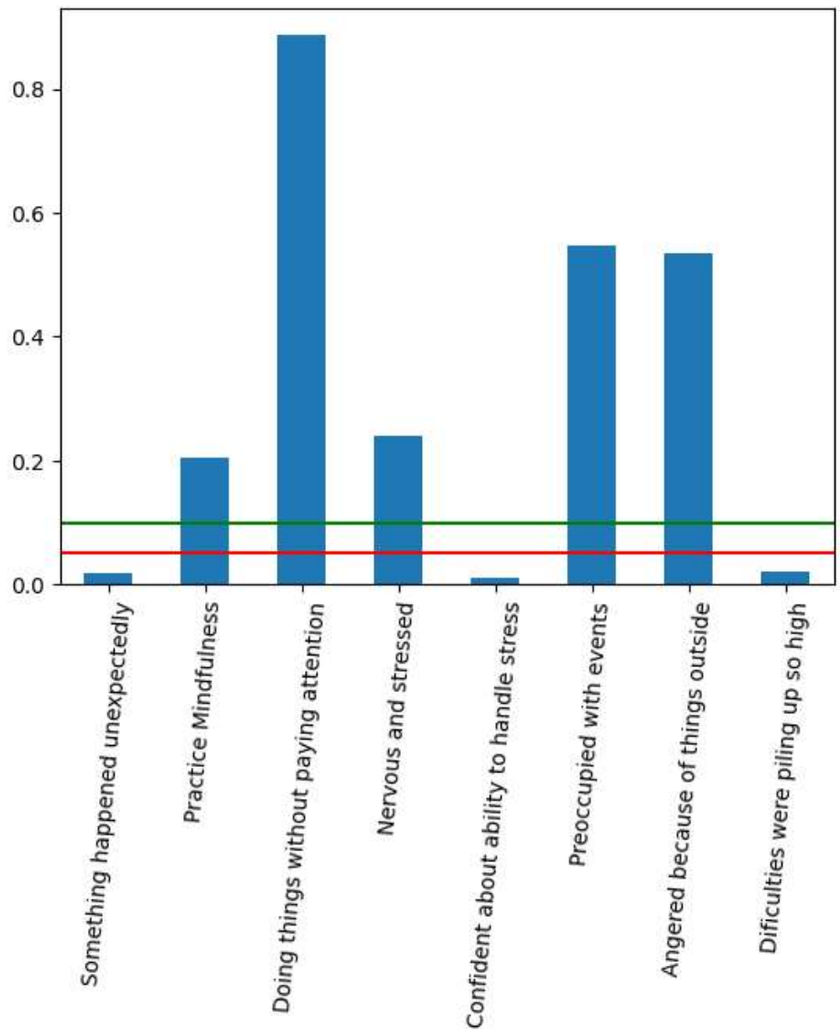
In [42]:
```
stat = {'ChiSQ': [], "p-value": []}

for column in columns_to_analyze:
    contingency_table = pd.crosstab(df_bio['exercise'], df_bio[column])

    chi2, p, _, _ = chi2_contingency(contingency_table)

    stat['ChiSQ'].append(chi2)
    stat['p-value'].append(p)


stat = pd.DataFrame(stat, index=c_names)
stat['alpha=5%'] = stat['p-value']<0.05
stat['alpha=10%'] = stat['p-value']<0.1

stat
```

Out[42]:

	ChiSQ	p-value	alpha=5%	alpha=10%
Something happened unexpectedly	30.113206	0.017424	True	True
Practice Mindfulness	20.348091	0.204950	False	False
Doing things without paying attention	9.614803	0.885955	False	False
Nervous and stressed	19.575826	0.239936	False	False
Confident about ability to handle stress	32.058208	0.009827	True	True
Preoccupied with events	14.690695	0.547398	False	False
Angered because of things outside	14.878598	0.533548	False	False
Dificulties were piling up so high	29.393143	0.021416	True	True

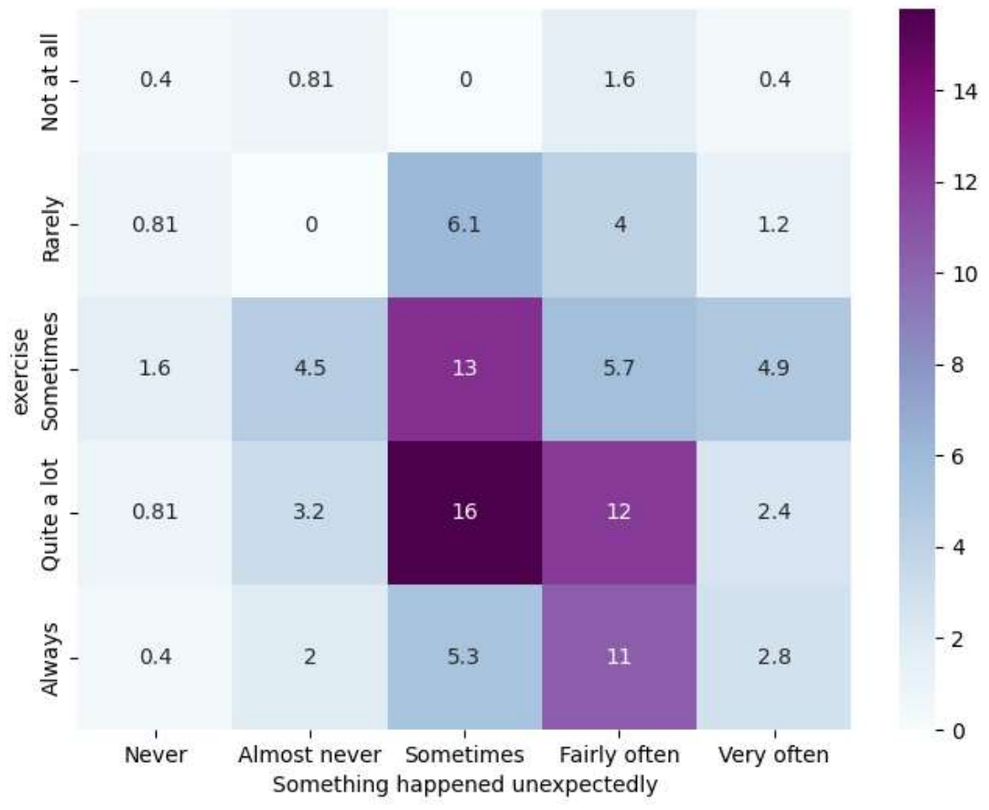
```
True = Associated with social media
False = Not associated with social media
```

In [43]:
```
stat['p-value'].plot(kind='bar')
plt.axhline(y=.05, color='r', label='Horizontal Line at y=15')
plt.axhline(y=.1, color='g', label='Horizontal Line at y=15')
plt.xticks(rotation=85)
plt.show()
```



For 5% tollarence 'Exercise' is associated with 'Something happened unexpectedly', 'Confident about ability to handle stress' and 'Dificulties were piling up so high' Let's have a look on heatmap.

In [44]:
```
gen_heatmap(df_bio, 'exercise', 'something_happened_unexpectedly')
```



In [45]:
```
gen_heatmap(df_bio, 'exercise', 'confident_about_ability_to_handl')
```

In [46]:
```
gen_heatmap(df_bio, 'exercise', 'dificulties_were_piling_up_so_hi')
```