For problem 1:

The data mining technique used in problem 1 is Apriori algorithm. We wanted to generate the frequent 3 itemset (a 3 tuple (item ID, hour number, student degree)). For this we added a dummy field to the table (all rows in this field have value as true).

Here only the antecedent support mattered, since in all rules, the consequent will be the dummy field. The minimum antecedent support was set to **0.4%**.

dummy_field	ItemID_154 Hour Number_22 Degree_F2
dummy_field	ItemID_154 Hour Number_22 Degree_F3
dummy_field	ItemID_154 Hour Number_23 Degree_F2
dummy_field	ItemID_154 Hour Number_23 Degree_F3
dummy_field	ItemID_151 Hour Number_21 Degree_F0
dummy_field	ItemID_151 Degree_F4 Hour Number_20
dummy_field	ItemID_151 Degree_F0 Hour Number_20
dummy_field	ItemID_151 Hour Number_20 Degree_F2
dummy_field	ItemID_151 Hour Number_20 Degree_F3

For September

dummy_field	Degree_F0 ItemID_151 Hour Number_20
dummy_field	ItemID_151 Hour Number_21 Degree_F3
dummy_field	ItemID_151 Hour Number_20 Degree_F4
dummy_field	ItemID_151 Hour Number_20 Degree_F3
dummy_field	ItemID_151 Hour Number_20 Degree_F2
dummy_field	ItemID_151 Hour Number_22 Degree_F3
dummy_field	ItemID_151 Hour Number_22 Degree_F2

For August

dummy_field	ItemID_151 Hour Number_21 Degree_F3
dummy_field	ItemID_151 Hour Number_20 Degree_F4
dummy_field	ItemID_151 Hour Number_20 Degree_F3
dummy_field	ItemID_151 Hour Number_20 Degree_F2
dummy_field	ItemID_151 Hour Number_22 Degree_F3
dummy_field	ItemID_151 Hour Number_23 Degree_F3
dummy_field	ItemID_151 Hour Number_23 Degree_F2

For October

dummy_field	ItemID_151 Degree_F1 Hour Number_23
dummy_field	ItemID_151 Hour Number_20 Degree_F4
dummy_field	ItemID_151 Hour Number_20 Degree_F3
dummy_field	ItemID_151 Hour Number_20 Degree_F2
dummy_field	ItemID_151 Hour Number_22 Degree_F3
dummy_field	ItemID_151 Hour Number_22 Degree_F2
dummy_field	ItemID_151 Hour Number_23 Degree_F2

For November

Performance Metrics:

Performance metrics used for this problem is minimum antecedent support.

Results: The increase in revenue comes out to be **1.5%** with penalty **7604.**

For problem 2:

For finding the combos of low support and high confidence:

First for each month the data was converted to transaction data and then it was converted to presence absence matrix. On this data, apriori algorithm was applied to get the combos. The minimum antecedent support for this was set to 0.1% and minimum rule confidence as 75%.

Consequent	Antecedent	Support %	Confidence %
item_151	item_159 item_146	0.119	100.0
item_151	item_146 item_155	0.362	95.522
item_151	item_164 item_130	0.114	95.238
item_151	item_146 item_161	0.103	94.737
item_151	item_164 item_134	0.103	94.737
item_151	item_146 item_154	0.281	94.231
item_151	item_164 item_155	0.352	93.846
item_151	item_146 item_164	0.238	93.182
item_151	item_164 item_154	0.465	93.023
item_151	item_164 item_156	0.211	92.308
item_151	item_139 item_164	0.162	90.0
item_151	item_146 item_148	0.481	88.764
item_151	item_146 item_128	0.189	88.571

For August

Consequent	Antecedent	Support %	Confidence %
item_151	item_164 item_148	0.146	97.101
item_151	item_156 item_164	0.102	95.833
item_151	item_164 item_154	0.365	94.186
item_151	item_146 item_164	0.199	93.617
item_151	item_164 item_76	0.363	93.567
item_151	item_164 item_169	0.195	93.478
item_151	item_146 item_154	0.227	93.458
item_151	item_146 item_76	0.403	91.053
item_151	item_164 item_128	0.157	90.541
item_151	item_146 item_169	0.121	87.719
item_151	item_146	2.973	84.237
item_151	item_146 item_148	0.246	83.621
item_151	item_164	2.956	82.353
item_151	item_166	0.416	77.041

For September

Consequent	Antecedent	Support %	Confidence %
item_151	item_146 item_142	0.107	94.231
item_151	item_146 item_76	0.23	93.75
item_151	item_164 item_76	0.193	93.617
item_151	item_164 item_169	0.146	92.958
item_151	item_164 item_146	0.23	92.857
item_151	item_146 item_154	0.195	92.632
item_151	item_146 item_169	0.141	91.304
item_151	item_164 item_154	0.24	90.598
item_151	item_146	3.162	82.879
item_151	item_164	2.99	79.492

For October

Consequent	Antecedent	Support %	Confidence %
item_151	item_164 item_154	0.149	92.727
item_151	item_146 item_142	0.111	92.683
item_151	item_146 item_134	0.111	92.683
item_151	item_146 item_154	0.144	92.453
item_151	item_164 item_128	0.171	92.063
item_151	item_164 item_146	0.225	91.566
item_151	item_146 item_76	0.315	90.517
item_151	item_164 item_76	0.166	90.164
item_151	item_146 item_128	0.179	89.394
item_151	item_146	4.658	80.875
item_151	item_164	2.784	79.024

For November

We couldnt make combos of low rating and high rating items. We only made combos of items which had low support and high confidence. The loss in revenue in the month of December came out to be:**4.17878018446%**. Total combos made were: **26**.

The performance metrics that can be used for this problem are confidence, lift.

For problem 3 the questions formed and the solutions are in another pdf.

The questions formed are on cash counter for cash payments and on the seasonal items, when to increase the prices of items or to discontinue an item for a month.