**Project III – Graph Visualizations**

**Cypher Action 1**

**Search Phrase:** Student who gotwriting\_letter\_grade=$writing\_letter\_grade and reading\_letter\_grade=$reading\_letter\_grade and w3. math\_letter\_grade= $math\_letter\_grade

#### Description: Find students who perform similar in all three exams or students are in the same set of grade letters for all exams

**Code:**

MATCH (p:Student)-[i1:HAS\_WRITING\_GRADE]-(w1:WritingGroup)

MATCH (p:Student)-[i2:HAS\_READING\_GRADE]-(w2:ReadingGroup)

MATCH (p:Student)-[i3:HAS\_MATH\_GRADE]-(w3:MathGroup)

WHERE (w1.writing\_letter\_grade=$writing\_letter\_grade) AND (w2.reading\_letter\_grade=$reading\_letter\_grade) AND (w3.math\_letter\_grade= $math\_letter\_grade)

RETURN p,i1,w1,i2,w2,i3,w3

Diagram

Description automatically generated

*Figure 1. Example about students who got A in writing, B in the reading, and C in math*

**Importance:** This cypher action allows the user to identify students who perform similar in all exams. To improve student’s grades, it’s very important to target student group with similar performance. Usually, different strategies will be used for student groups to improve their grades. Inviting different student groups to let them share learning experience in the area they are good at.

**Cypher Action 2**

**Search Phrase:** Student who took test\_preparation\_course $test\_preparation\_course and got reading\_letter\_grade $reading\_letter\_grade

**Description:** Find Student who perform good at one exam and complete the test preparation course.

**Code:**

MATCH (p:Student)-[i1:HAS\_READING\_GRADE]-(w:ReadingGroup)

WHERE p.test\_preparation\_course= $test\_preparation\_course AND w.reading\_letter\_grade= $reading\_letter\_grade

RETURN p, i1, w

Chart

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*Figure 2. Student who completed the test preparation course and got A in reading exam*

**Importance**: Test preparation is usually important for students to have a good grade in the exam. This cypher action allows school to find the best students in one exam and complete test preparation. Those students can be invited to share their opinions about if or how test preparation is useful for the course they are good at.

**Cypher Action 3**

**Search Phrase:** Information about student $student\_id

**Description:** Search for student all information given student\_id.

**Code:**

MATCH(r:Race)<-[b:BELONG]-(s:Student)-[b1:HAS]->(p:PrentalLevelOfEducation)

MATCH(m:MathGroup)<-[r1:HAS\_MATH\_GRADE]-(s:Student)-[r2:HAS\_READING\_GRADE]->(m1:ReadingGroup)

MATCH (w:WritingGroup)<-[r3:HAS\_WRITING\_GRADE]-(s:Student)

WHERE s.student\_id=$student\_id

return r,b,s,b1,p,m,r1,r2,m1,w,r3

*Diagram

Description automatically generated*

*Figure 3. Information about student 1.*

**Importance**: From this cypher query, it’s easy to find specific information about one student such as gender, race, parental education level and exam results, etc.

**Cypher Action 4**

**Search Phrase:** Student's parental level of education is $degree and student in $group

**Description:** Find students who has specific parental education level in specific racial group

**Code:**

MATCH (p:PrentalLevelOfEducation{degree:$degree})<-[r2:HAS]-(s:Student)-[r1:BELONG]->(g:Race{group:$group})

RETURN p, r2, s, r1, g

*Diagram

Description automatically generated*

*Figure 4. Students who have high school parental education level are in racial group A*

**Importance**: From this cypher query, it’s easy to check students’ family and racial background.

**Visualizations 1**

**Code:**

MATCH (p:Student)-[i1:HAS\_WRITING\_GRADE]-(w1:WritingGroup)

MATCH (p:Student)-[i2:HAS\_READING\_GRADE]-(w2:ReadingGroup)

MATCH (p:Student)-[i3:HAS\_MATH\_GRADE]-(w3:MathGroup)

WHERE (w1.writing\_letter\_grade="A" AND w2.reading\_letter\_grade="A" AND w3.math\_letter\_grade= "A"AND TEST) OR (w1.writing\_letter\_grade="F" AND w2.reading\_letter\_grade="F" AND w3.math\_letter\_grade= "F")

RETURN p,i1,w1,i2,w2,i3,w3

**A picture containing diagram

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*Figure 5. Comparison of best student group and worst student group*   
Figure 5 shows that there are two screenshots of visualization for size comparison of best student group and worst student group. Left plot is general framework of two groups and right plot show more detail information of one group. In the left plot, the left group contains students who got A in all three exams and right group contains students who got F in all three exams. Those visualization allows to easily identify the best student group and the worst one and to understand size difference between two groups. In general, there are much fewer students in the best group than that in the worst group, which indicates that exams are not easy, and students did not perform well in general.

**Graph Visualizations 2**

**Code:**

MATCH (p:Student) - [a1:HAS]- (p1:PrentalLevelOfEducation)

MATCH (p:Student)-[i1:HAS\_WRITING\_GRADE]->(w1:WritingGroup)

MATCH (p:Student)-[i2:HAS\_READING\_GRADE]-(w2:ReadingGroup)

MATCH (p:Student)-[i3:HAS\_MATH\_GRADE]-(w3:MathGroup)

WHERE

(w1.writing\_letter\_grade="A" AND w2.reading\_letter\_grade="A" AND w3.math\_letter\_grade= "A" AND p1.degree="bachelor's degree") OR

(w1.writing\_letter\_grade="A" AND w2.reading\_letter\_grade="A" AND w3.math\_letter\_grade= "A" AND p1.degree= "master's degree") OR

(w1.writing\_letter\_grade="A" AND w2.reading\_letter\_grade="A" AND w3.math\_letter\_grade= "A" AND p1.degree= "high school")

RETURN p,i1,w1,i2,w2,i3,w3,a1,p1

**Diagram

Description automatically generated**

*Figure 6. Parental education level for the best student group*

Figure 6 shows the screenshot of visualization for checking parental education level for the best student group who got A in all three exams. Basically, there are three parental degrees for students: high school degree, bachelor’s degree, and master’s degree. From this plot, it’s easy to see that there is only student in this group who has parents with high school education and most of best students has parents with bachelor’s degree or higher. Therefore, parental education will directly or indirectly affect students’ performance in the school.