

## Milestone 2

February 27, 2022

Project Group Number on Canvas: n/a; group named “group 0”

Name	Student ID	CS Alias	Preferred Email Address
Steven Li	95102885	i0z2b	listeven39@gmail.com
Ethan Lin	56009681	n4h3b	ethan1688.lin@gmail.com
Anton Chen	75858795	y5y2b	antonzychen@gmail.com

By typing our names and student numbers in the above table, we certify that the work in the attached assignment was performed solely by those whose names and student IDs are included above. (In the case of Project Milestone 0, the main purpose of this page is for you to let us know your e-mail address, and then let us assign you to a TA for your project supervisor.)

In addition, we indicate that we are fully aware of the rules and consequences of plagiarism, as set forth by the Department of Computer Science and the University of British Columbia

## 2 Schema

With respect to the following schemas, attributes which are underlined denote primary key attributes, and attributes which are **bolded** denote foreign key attributes.

- Applicant( ApplicantID: int, FirstName: varchar, LastName: varchar )
- Application( CoverLetterLink: varchar, ResumeLink: varchar, Decision: enum, **ApplicantID**: int, **PostingID**: int, **RecruiterID**: int, **CompanyName**: varchar NOT NULL )
- Internship( PostingID : int, Salary: int, StartDate: date, JobDescription: varchar, CompanyName: varchar )
- FullTime( PostingID : int, Salary: int, StartDate: date, JobDescription: varchar, Location varchar, **CompanyName**: varchar NOT NULL )
- Recruiter( RecruiterID : int, FirstName: varchar, LastName: varchar, **CompanyName**: varchar NOT NULL )
- Company( CompanyName : varchar, StreetName: varchar, City: varchar, StateProvince: varchar, Country: varchar, PostalCode: varchar )
- Interviewer( InterviewerID : int, FirstName: varchar, LastName: varchar, Position: varchar, **CompanyName**: varchar NOT NULL )
- Host( **InterviewID**: int, **InterviewerID**: int )
- OnlineAssessment( InterviewID : int, PositionType: varchar, Duration: int, Difficulty: varchar, NumberOfQuestions: int, CutoffScore: int, StartDateTime: date, EndDateTime: date, **ApplicantID**: int, **PostingID**: int )
- PhoneScreen( InterviewId : int, StartDateTime: date, EndDateTime: date, **ApplicantID**: int, **PostingID**: int )
- OnsiteInterview( InterviewId : int, StartDateTime: date, EndDateTime: date, **ApplicantID**: int, **PostingID**: int )
- TeamMatching( InterviewId : int, StartDateTime: date, EndDateTime: date, **ApplicantID**: int, **PostingID**: int )
- InformationSession( SessionID: int, Location: varchar, Datetime: date, **CompanyName**: varchar NOT NULL )
- Participate( **ApplicantID**: int, **PostingID** int, **SessionID**: int )

### 3 SQL DDL

```
1 CREATE TABLE Applicant (  
2     ApplicationID      int,  
3     FirstName          varchar(50),  
4     LastName           varchar(50),  
5     PRIMARY KEY (ApplicationID)  
6 )  
7  
8 CREATE TABLE Application (  
9     ApplicationID      int,  
10    CoverLetterLink    varchar(100),  
11    ResumeLink         varchar(100),  
12    Decision           varchar(20),  
13    ApplicantID        int,  
14    PostingID          int,  
15    RecruiterID        int DEFAULT NULL,  
16    CompanyName        varchar(100) NOT NULL,  
17    PRIMARY KEY (ApplicantID, PostingID),  
18    FOREIGN KEY (ApplicantID)  
19        REFERENCES Applicant (ApplicantID)  
20        ON DELETE CASCADE,  
21    FOREIGN KEY (PostingID)  
22        REFERENCES Posting (PostingID)  
23        ON DELETE CASCADE,  
24    FOREIGN KEY (RecruiterID)  
25        REFERENCES Recruiter (RecruiterID)  
26        ON DELETE SET DEFAULT,  
27    FOREIGN KEY (CompanyName)  
28        REFERENCES Company (CompanyName)  
29        ON DELETE CASCADE  
30 )  
31  
32 CREATE TABLE Internship (  
33     PostingID          int,  
34     Salary             int,  
35     StartDate          date,  
36     JobDescription      varchar(100000),  
37     Location           varchar(100),  
38     CompanyName        varchar(100) NOT NULL,  
39     PRIMARY KEY (PostingID),  
40     FOREIGN KEY (CompanyName)  
41        REFERENCES Company (CompanyName)  
42        ON DELETE CASCADE  
43 )
```

```

44
45 CREATE TABLE FullTime (
46     PostingID          int,
47     Salary              int,
48     StartDate           date,
49     JobDescription       varchar(100000),
50     Location             varchar(100),
51     CompanyName          varchar(100) NOT NULL,
52     PRIMARY KEY (PostingID),
53     FOREIGN KEY (CompanyName)
54         REFERENCES Company (CompanyName)
55         ON DELETE CASCADE
56 )
57
58 CREATE TABLE Company (
59     CompanyName          varchar(100),
60     StreetName            varchar(100),
61     City                  varchar(100),
62     StateProvince         varchar(100),
63     Country                varchar(100),
64     PostalCode             varchar(50),
65     PRIMARY KEY (CompanyName)
66 )
67
68 CREATE TABLE Interviewer (
69     InterviewerID         int,
70     FirstName              varchar(50),
71     LastName               varchar(50),
72     Position               varchar(50),
73     CompanyName            varchar(100) NOT NULL,
74     PRIMARY KEY (InterviewerID),
75     FOREIGN KEY (CompanyName)
76         REFERENCES Company (CompanyName)
77         ON DELETE CASCADE
78 )
79
80 CREATE TABLE Host (
81     InterviewID            int,
82     InterviewerID          int DEFAULT NULL,
83     PRIMARY KEY (InterviewID, InterviewerID),
84     FOREIGN KEY (InterviewID)
85         REFERENCES Interview (InterviewID)
86         ON DELETE CASCADE,
87     FOREIGN KEY (InterviewerID)
88         REFERENCES Interviewer (InterviewerID)
89         ON DELETE SET DEFAULT

```

```

90 )
91
92 CREATE TABLE OnlineAssessment (
93     InterviewID        int,
94     PositionType       varchar(50),
95     Duration           int,
96     Difficulty         varchar(10),
97     NumberOfQuestions int,
98     CutoffScore        int,
99     StartDateTime      date,
100    EndDateTime         date,
101    ApplicantID        int NOT NULL,
102    PostingID          int NOT NULL,
103    PRIMARY KEY (InterviewID),
104    FOREIGN KEY (ApplicantID, PostingID)
105        REFERENCES Application (ApplicantID, PostingID)
106        ON DELETE CASCADE
107 )
108
109 CREATE TABLE PhoneScreen (
110     InterviewID        int,
111     StartDateTime      date,
112     EndDateTime        date,
113     ApplicantID        int NOT NULL,
114     PostingID          int NOT NULL,
115     PRIMARY KEY (InterviewID),
116     FOREIGN KEY (ApplicantID, PostingID)
117        REFERENCES Application (ApplicantID, PostingID)
118        ON DELETE CASCADE
119 )
120
121 CREATE TABLE OnsiteInterview (
122     InterviewID        int,
123     StartDateTime      date,
124     EndDateTime        date,
125     ApplicantID        int NOT NULL,
126     PostingID          int NOT NULL,
127     PRIMARY KEY (InterviewID),
128     FOREIGN KEY (ApplicantID, PostingID)
129        REFERENCES Application (ApplicantID, PostingID)
130        ON DELETE CASCADE
131 )
132
133 CREATE TABLE TeamMatching (
134     InterviewID        int,
135     StartDateTime      date,

```

```

136     EndDateTime          date,
137     ApplicantID          int NOT NULL,
138     PostingID            int NOT NULL,
139     PRIMARY KEY (InterviewID),
140     FOREIGN KEY (ApplicantID, PostingID)
141         REFERENCES Application (ApplicantID, PostingID)
142         ON DELETE CASCADE
143 )
144
145 CREATE TABLE Recruiter (
146     RecruiterID          int,
147     FirstName            varchar(50),
148     LastName             varchar(50),
149     CompanyName          varchar(100) NOT NULL,
150     PRIMARY KEY (RecruiterID),
151     FOREIGN KEY (CompanyName)
152         REFERENCES Company (CompanyName)
153         ON DELETE CASCADE
154 )
155
156 CREATE TABLE Post (
157     ApplicantID          int,
158     PostingID            int,
159     CompanyName          varchar(100) NOT NULL,
160     PRIMARY KEY (ApplicantID, PostingID),
161     FOREIGN KEY (ApplicantID, PostingID)
162         REFERENCES Application (ApplicantID, PostingID),
163         ON DELETE CASCADE
164     FOREIGN KEY (CompanyName)
165         REFERENCES Company (CompanyName)
166         ON DELETE CASCADE
167 )
168
169 CREATE TABLE InformationSession (
170     SessionID            int,
171     Location              varchar(100),
172     DateTime              date,
173     CompanyName          varchar(100) NOT NULL,
174     PRIMARY KEY (SessionID),
175     FOREIGN KEY (CompanyName)
176         REFERENCES Company (CompanyName)
177         ON DELETE CASCADE
178 )
179
180 CREATE TABLE Participates (
181     ApplicantID          int,

```

```

182 PostingID          int,
183 SessionID         int,
184 PRIMARY KEY (ApplicantID, PostingID, SessionID),
185 FOREIGN KEY (ApplicantID, PostingID)
186     REFERENCES Application (ApplicantID, PostingID)
187     ON DELETE CASCADE,
188 FOREIGN KEY (SessionID)
189     REFERENCES InformationSessionHosting(SessionID)
190     ON DELETE CASCADE
191 )

```

## 4 Functional Dependencies

- Applicant
  - ApplicantId  $\rightarrow$  FirstName, LastName
- Application
  - ApplicantId, PostingId  $\rightarrow$  CoverLetterLink, ResumeLink, Decision, RecruiterId
- Internship
  - Salary, StartDate  $\rightarrow$  JobDescription, Location, CompanyName
- FullTime
  - Salary, StartDate  $\rightarrow$  JobDescription, Location, CompanyName
- Recruiter:
  - RecruiterId  $\rightarrow$  FirstName, LastName, CompanyName
- Company:
  - CompanyName  $\rightarrow$  StreetName, City, StateProvince, Country, PostalCode
  - PostalCode, Country  $\rightarrow$  City, StateProvince, StreetName
- Interviewer:
  - InterviewerID  $\rightarrow$  FirstName, LastName, Position, CompanyName
- Host:
  - No non-trivial FDs.
- OnlineAssessment
  - InterviewId  $\rightarrow$  PositionType, Duration, Difficulty, NumberOfQuestions, CutoffScore, StartDateTime, EndDateTime, ApplicantID, PostingID
  - PositionType  $\rightarrow$  Duration, Difficulty, NumberOfQuestions, CutoffScore
- PhoneScreen
  - InterviewId  $\rightarrow$  StartDateTime, EndDateTime
- OnsiteInterview
  - InterviewId  $\rightarrow$  StartDateTime, EndDateTime
- TeamMatching
  - InterviewId  $\rightarrow$  StartDateTime, EndDateTime



- InformationSession
  - SessionId  $\rightarrow$  Location, Datetime, CompanyName
- Host
  - SessionID  $\rightarrow$  CompanyName
- Participate
  - No non-trivial FDs.

(note: the **Company** and **OnlineAssessment** relations include non-trivial primary key dependencies, and do not satisfy BCNF.)

## 5 Normalization

We use the lossless-join BCNF decomposition algorithm in order to ensure the relations follow the BCNF specification. Since all relations are in BCNF except for the **Company** and **OnlineAssessment** relations, we simply need to apply the algorithm on these two relations. All other relations are the same.

To begin, we decompose the **Company** relation.

1. Company(CompanyName, StreetName, City, StateProvince, Country, PostalCode)
2. Company1(PostalCode, Country, City, StateProvince, StreetName), Company2(CompanyName, Country, PostalCode)
  - (by PostalCode, Country  $\rightarrow$  City, StateProvince, StreetName)

Next, we decompose the **OnlineAssessment** relation.

1. OnlineAssessment(InterviewId, PositionType, Duration, Difficulty, NumberOfQuestions, CutoffScore, StartDateTime, EndDateTime, ApplicantID, PostingID)
2. OnlineAssessment1(PositionType, Duration, Difficulty, NumberOfQuestions, CutoffScore), OnlineAssessment2(InterviewId, PositionType, StartDateTime, EndDateTime, ApplicantID, PostingID)
  - (by PositionType  $\rightarrow$  Duration, Difficulty, NumberOfQuestions, CutoffScore)

Hence we arrive at the following list of tables, their primary keys, their candidate keys, and their foreign keys after normalization.

- Applicant( ApplicantID: int, FirstName: varchar, LastName: varchar )
- Application( CoverLetterLink: varchar, ResumeLink: varchar, Decision: enum, ApplicantID: int, PostingID: int, **RecruiterID** : int, **CompanyName**: varchar NOT NULL )
- Internship( PostingID : int, Salary: int, StartDate: date, JobDescription: varchar, CompanyName: varchar )
- FullTime( PostingID : int, Salary: int, StartDate: date, JobDescription: varchar, Location varchar, **CompanyName**: varchar NOT NULL )
- Recruiter( RecruiterID : int, FirstName: varchar, LastName: varchar, **CompanyName**: varchar NOT NULL )
- Company1( CompanyName : varchar, **Country**: varchar, **PostalCode**: varchar )
- Company2( PostalCode : varchar, Country : varchar, City: varchar, StateProvince: varchar, StreetName: varchar )

- Interviewer( InterviewerID : int, FirstName: varchar, LastName: varchar, Position: varchar, **CompanyName**: varchar NOT NULL )
- Host( **InterviewID**: int, **InterviewerID**: int )
- OnlineAssessment1( PositionType : varchar, Duration: int, Difficulty: varchar, NumberOfQuestions: int, CutoffScore: int, )
- OnlineAssessment2( InterviewID : int, **PositionType** : varchar, StartDateTime: date, EndDateTime: date, **ApplicantID**: int, **PostingID**: int )
- PhoneScreen( InterviewId : int, StartDateTime: date, EndDateTime: date, **ApplicantID**: int, **PostingID**: int )
- OnsiteInterview( InterviewId : int, StartDateTime: date, EndDateTime: date, **ApplicantID**: int, **PostingID**: int )
- TeamMatching( InterviewId : int, StartDateTime: date, EndDateTime: date, **ApplicantID**: int, **PostingID**: int )
- InformationSession( SessionID: int, Location: varchar, Datetime: date, **CompanyName**: varchar NOT NULL )
- Participate( **ApplicantID**: int, **PostingID** int, **SessionID**: int )

## 6 Populating Tables

We populate the above tables with the following data:

```
1 Applicant(ApplicantID, FirstName, LastName)
2 (95102885, 'Steven', 'Li')
3 (56009681, 'Ethan', 'Lin')
4 (75758795, 'Anton', 'Chen')
5 (10000000, 'Raymond', 'Ng')
6 (10000001, 'Kanye', 'West')
7
8 Application(CoverLetterLink, ResumeLink, Decision, ApplicantID,
9   ↳ PostingID, RecruiterID, CompanyName)
10 ('stevenli.com/coverletter.pdf', 'stevenli.com/resume.pdf',
11   ↳ 'Offer', 95102885, 10000000, 30000000, 'Asana')
12 ('ethanlin.com/coverletter.pdf', 'ethanlin.com/resume.pdf',
13   ↳ 'Accepted', 56009681, 10000001, 30000001, 'Google')
14 ('antonchen.com/coverletter.pdf', 'antonchen.com/resume.pdf',
15   ↳ 'Rejected', 75758795, 10000002, 30000002, 'Amazon')
16
17 Internship(PostingID, Salary, StartDate, JobDescription,
18   ↳ Location, CompanyName)
19 (1000, 10, 10/22/2022, 'janitor', 'company bathroom', 'Happy
20   ↳ Land')
21 (1001, 50, 5/1/2022, 'secretary', 'office', 'Google')
22 (1002, 100, 12/4/2022, 'sales', 'office', 'Housekeeper')
23 (1003, 500, 10/30/2022, 'worker', 'warehouse', 'Amazon')
24 (1004, 30, 2/28/2023, 'sorting documents', 'office', 'Google')
25
26 FullTime(PostingID, Salary, StartDate, JobDescription, Location,
27   ↳ CompanyName)
28 (1005, 10, 10/22/2022, 'janitor', 'company bathroom', 'Happy
29   ↳ Land')
30 (1006, 50, 5/1/2022, 'secretary', 'office', 'Google')
31 (1007, 100, 12/4/2022, 'sales', 'office', 'Housekeeper')
32 (1008, 500, 10/30/2022, 'worker', 'warehouse', 'Amazon')
33 (1009, 30, 2/28/2023, 'sorting documents', 'office', 'Google')
34
35 Recruiter(RecruiterID, FirstName, LastName, CompanyName)
36 (7800776, 'Steven', 'Li', 'Amazon')
37 (4352343, 'Ethan', 'Lin', 'Amazon')
38 (4365645, 'Anton', 'Chen', 'Happy Land')
39 (4537451, 'Raymond', 'Ng', 'Housekeeper')
40 (1232433, 'Kanye', 'West', 'Google')
```

```

34 Company(CompanyName, StreetName, City, StateProvince, Country,
    ↪ PostalCode)
35 ('Amazon', 'Vine', 'Vancouver', 'BC', 'Canada', 'V2A3A6')
36 ('Google', 'Heather', 'Vancouver', 'BC', 'Canada', 'V6H7A6')
37 ('Happy', 'Queen', 'Vancouver', 'BC', 'Canada', 'V1N4B6')
38 ('Housekeeper', 'Oak', 'Vancouver', 'BC', 'Canada', 'V7A5A6')
39 ('Asana', 'Victoria', 'Vancouver', 'BC', 'Canada', 'V2H7U6')
40
41 Interviewer(InterviewerID, FirstName, LastName, Position,
    ↪ CompanyName)
42 (7800776, 'Steven', 'Li', 'Amazon')
43 (4352343, 'Ethan', 'Lin', 'Amazon')
44 (4365645, 'Anton', 'Chen', 'Happy Land')
45 (4537451, 'Raymond', 'Ng', 'Housekeeper')
46 (1232433, 'Kanye', 'West', 'Google')
47
48 Host(InterviewID, InterviewerID)
49 (7800776, 586785947)
50 (4352343, 928143721)
51 (4365645, 983473298)
52 (4537451, 921837921)
53 (4532421, 872463872)
54
55 OnlineAssessment1(PositionType, Duration, Difficulty,
    ↪ NumberOfQuestions, CutoffScore)
56 ('FullTime', 3, 'Easy', 5, 90)
57 ('FullTime', 5, 'Hard', 5, 10)
58 ('Intern', 1, 'Easy', 100, 50)
59 ('FullTime', 6, 'Hard', 60, 70)
60 ('Intern', 12, 'Medium', 90, 30)
61
62 OnlineAssessment2(InterviewId, PositionType, StartDateTime,
    ↪ EndDateTime, ApplicantID, PostingID)
63 (7800776, 586785947, 'FullTime', 5/1/2022, 10/30/2022,
    ↪ 762134827, 73648712)
64 (4352343, 928143721, 'FullTime', 12/4/2022, 3/5/2023, 824637129,
    ↪ 271863427)
65 (4365645, 983473298, 'Intern', 10/22/2022, 12/30/2022,
    ↪ 21984721987, 3984979128)
66 (4537451, 921837921, 'FullTime', 2/28/2023, 2/28/2024, 29387210,
    ↪ 2198347219)
67 (4532421, 872463872, 'Intern', 10/30/2022, 10/30/2022, 29837219,
    ↪ 129783378)
68
69 PhoneScreen(InterviewId, PositionType, Duration, StartDateTime,
    ↪ EndDateTime, ApplicantID, PostingID)

```

```

70 (7800776, 586785947, 'FullTime', 10, 5/1/2022, 10/30/2022,
    ↳ '762134827', '73648712')
71 ('4352343', '928143721', 'FullTime', '10', '12/4/2022',
    ↳ '3/5/2023', '824637129', '271863427')
72 ('4365645', '983473298', 'Intern', '5', '10/22/2022',
    ↳ '12/30/2022', '21984721987', '3984979128')
73 ('4537451', '921837921', 'FullTime', '8', 2/28/2023',
    ↳ '2/28/2024', '29387210', '2198347219')
74 ('4532421', '872463872', 'Intern', '20', '10/30/2022',
    ↳ '10/30/2022', '29837219', '129783378')
75
76 OnsiteInterview(InterviewId, PositionType, Duration,
    ↳ StartDateTime, EndDateTime, ApplicantID, PostingID)
77 ('7800776', '586785947', 'FullTime', '10', '5/1/2022',
    ↳ '10/30/2022', '762134827', '73648712')
78 ('4352343', '928143721', 'FullTime', '10', '12/4/2022',
    ↳ '3/5/2023', '824637129', '271863427')
79 ('4365645', '983473298', 'Intern', '5', '10/22/2022',
    ↳ '12/30/2022', '21984721987', '3984979128')
80 ('4537451', '921837921', 'FullTime', '8', 2/28/2023',
    ↳ '2/28/2024', '29387210', '2198347219')
81 ('4532421', '872463872', 'Intern', '20', '10/30/2022',
    ↳ '10/30/2022', '29837219', '129783378')
82
83 TeamMatching(InterviewId, PositionType, Duration, StartDateTime,
    ↳ EndDateTime, ApplicantID, PostingID)
84 ('7800776', '586785947', 'FullTime', '10', '5/1/2022',
    ↳ '10/30/2022', '762134827', '73648712')
85 ('4352343', '928143721', 'FullTime', '10', '12/4/2022',
    ↳ '3/5/2023', '824637129', '271863427')
86 ('4365645', '983473298', 'Intern', '5', '10/22/2022',
    ↳ '12/30/2022', '21984721987', '3984979128')
87 ('4537451', '921837921', 'FullTime', '8', 2/28/2023',
    ↳ '2/28/2024', '29387210', '2198347219')
88 ('4532421', '872463872', 'Intern', '20', '10/30/2022',
    ↳ '10/30/2022', '29837219', '129783378')
89
90 InformationSessionHosting(SessionID, Location, Datetime,
    ↳ CompanyName)
91 ('7800776', 'zoom', '5/1/2022', 'Google')
92 ('3847219', 'zoom', '5/10/2022', 'Google')
93 ('2839721', 'zoom', '10/10/2022', 'Amazon')
94 ('7238121', 'zoom', '11/11/2022', 'Amazon')
95 ('2823980', 'zoom', '12/12/2022', 'Asana')
96
97 Participate(ApplicantID, PostingID, SessionID)

```

```
98 ('7800776', '586785947', '23232322')
99 ('4352343', '928143721', '23254654')
100 ('4365645', '983473298', '32323223')
101 ('4537451', '921837921', '23235455')
102 ('4532421', '872463872', '325465676')
```