University of British Columbia
Department of Computer Science

CPSC 304 S1 2019

Group Project - Implementation of a Relational Database

Project Title:	Hero Database
Project Milestone:	Milestone 3

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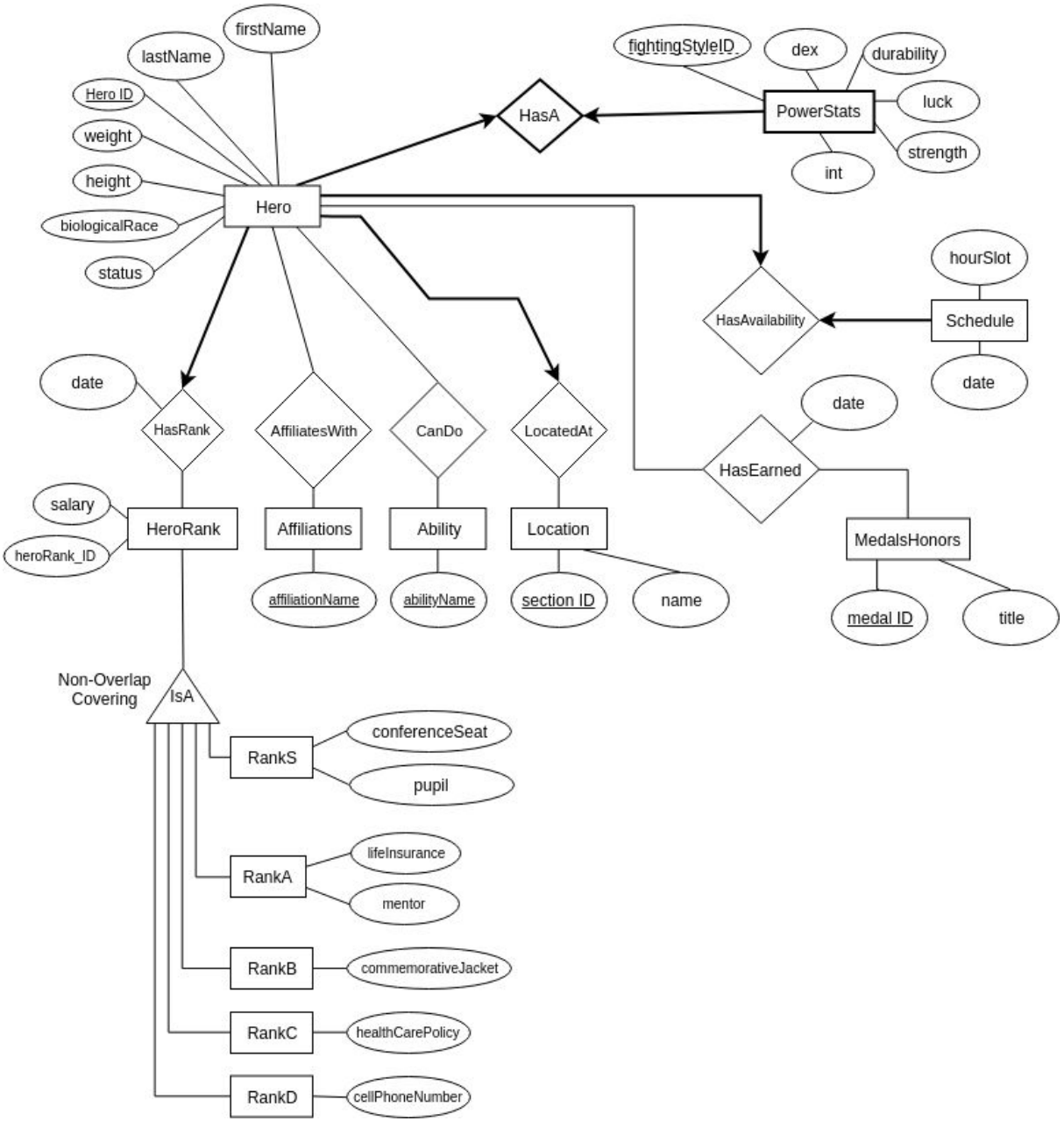
By typing our names and student numbers in the above table, we certify that the work in the attached assignment was performed solely by those whose names and student IDs are included above.
In addition, we indicate that we are fully aware of the rules and consequences of plagiarism, as set forth by the Department of Computer Science and the University of British Columbia

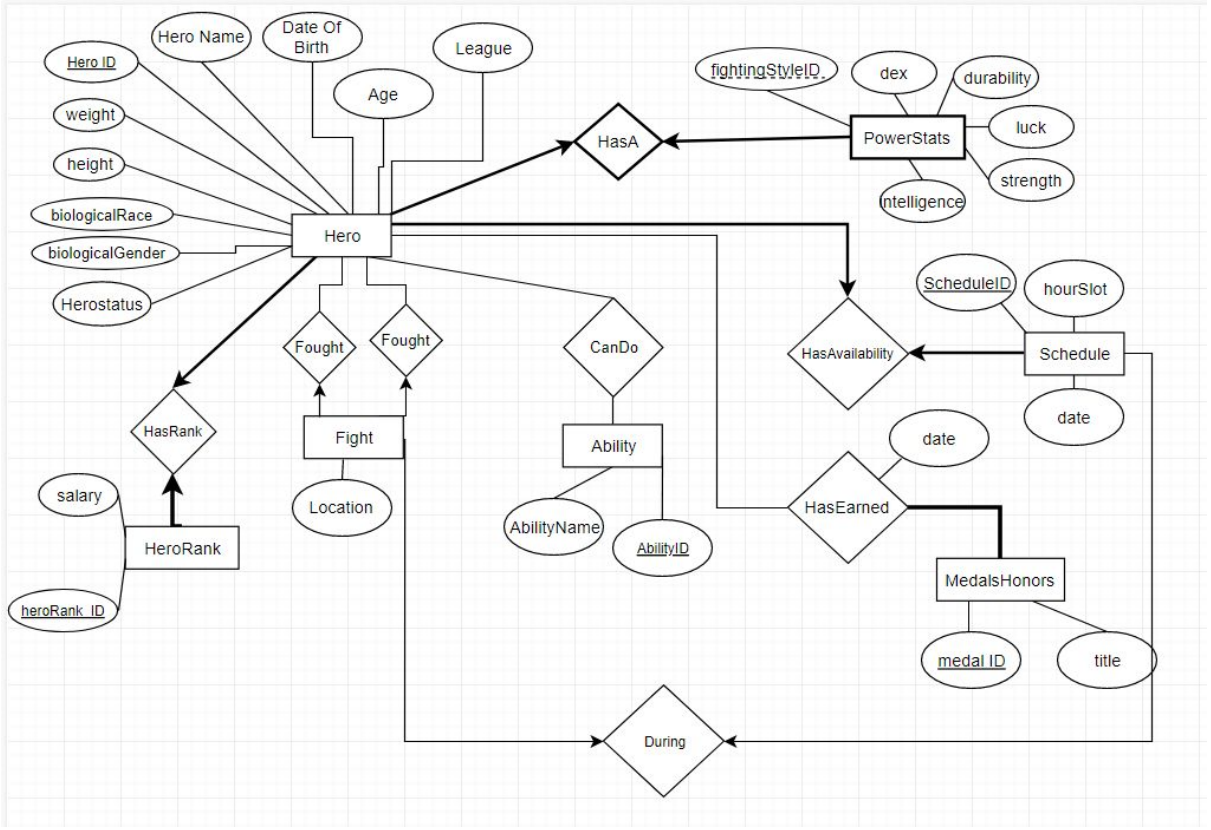
Preface

Following feedback on last weeks ERD diagram, we have decided to follow the TA's advice and alter the structure slightly

Original



Revision



The assignment below will be done with respect to the newly revised version.

Functional Dependencies

Hero

Table	FD	Candidate Key	Normalize?
Hero (heroName, HeroID, weight, height, biologicalRace,heroStatus, DOB, Age, league, ability)	• DOB → Age • (DOB heroName) → HeroID • HeroID → (heroName, HeroID, weight, height, Affiliations, Location, biologicalRace, heroStatus, DOB, Age)	• heroName, DOB • HeroID	**Yes**
PowerStats (PowerStatsID, dex, durability, luck, strength, intelligence)	• PowerStatsID → Dex, Durability, Luck, Strength, Intelligence	• PowerStatsID	No
Schedule (hourSlot,sDate, scheduleID)	• scheduleID → sDate, hourSlot	• scheduleID	No
MedalHonors (medalID, title)	• medalID → Title	• medalID	No
Fight (fightID, Winner, Loser, Location, fightTime)	• (fightTime location) → winner, loser, • fightID → Winner, Loser, Location, fightTime	• fightID	**Yes**
HasEarnedMedal (medalID,HeroID,Date)	• HeroID, medalID → Date	• HeroID, medalID	No
Ability (AbilityID, AbilityName)	• AbilityID → AbilityName	• AbilityID	No
HasAbility (HeroID,AbilityID, TotalAbilities)	• HeroID,AbilityID → TotalAbilities	• HeroID, AbilityID	No
HeroRank (heroRankID, salary, HeroID)	• heroRankID → salary, HeroID	• heroRankID	No

Normalization

Hero Table

Step 1: Reduce RHS

DOB → Age

(DOB, heroName) → HeroID

HeroID → heroName

HeroID → Weight

HeroID → Height
HeroID → Affiliations
HeroID → Location
HeroID → biologicalRace
HeroID → heroStatus
HeroID → DOB
HeroID → Age

Step 2: Reduce LHS - None of them can be reduced

Step 3: Eliminate Redundant FD's

FD	**Closure with FD**	**Closure without FD**	**Result**	**Final FD**
DOB→Age	DOB,Age	DOB	Keep	DOB->Age
(DOB, heroName) → HeroID	DOB,heroName,HeroID	DOB,heroName,Age	Keep	(DOB, heroName) → HeroID
HeroID → heroName	HeroID, heroname,weight, height,Affiliations, Location,biologicalRace, heroStatus, DOB,Age	HeroID,weight, height,Affiliations, Location,biologicalRace, heroStatus, DOB,Age	Keep	HeroID → heroName
HeroID → Weight	HeroID, weight, height,Affiliations, Location,biologicalRace, heroStatus, DOB,Age, heroName	HeroID, height,Affiliations, Location,biologicalRace, heroStatus, DOB,Age, heroName	Keep	HeroID → Weight
HeroID → Height	HeroID, weight, height,Affiliations, Location,biologicalRace, heroStatus, DOB,Age, heroName	HeroID, weight,Affiliations, Location,biologicalRace, heroStatus, DOB, Age, heroName	Keep	HeroID → Height
HeroID → Affiliations	HeroID, weight, height,Affiliations, Location,biologicalRace, heroStatus, DOB,Age, heroName	HeroID, weight, height, Location, biologicalRace, heroStatus, DOB, Age, heroName	Keep	HeroID → Affiliations
HeroID → Location	HeroID, weight, height,Affiliations, Location,biologicalRace, heroStatus, DOB,Age, heroName	HeroID, weight, height, Affiliations,biologicalRace, heroStatus, DOB, Age, heroName	Keep	HeroID → Location

HeroID → biologicalRace	HeroID, weight, height,Affiliations, Location,biologicalRace, heroStatus, DOB,Age, heroName	HeroID, weight, height, Affiliations, Location, heroStatus, DOB,Age, heroName	Keep	HeroID → biologicalRace
HeroID → heroStatus	HeroID, weight, height,Affiliations, Location,biologicalRace, heroStatus, DOB,Age, heroName	HeroID, weight, height, Affiliations, Location, biologicalRace, DOB, Age, heroName	Keep	HeroID → heroStatus
HeroID → DOB	HeroID, weight, height,Affiliations, Location,biologicalRace, heroStatus, DOB,Age, heroName	HeroID, weight, height,Affiliations, Location,biologicalRace, heroStatus,Age, heroName	Keep	HeroID → DOB
HeroID → Age	HeroID, weight, height, Affiliations, Location, biologicalRace, heroStatus, DOB, Age, heroName	HeroID, weight, height, Affiliations, Location, biologicalRace, heroStatus, DOB, Age, heroName	Discard	

Minimal Cover:

1. DOB → Age
2. (DOB, heroName) → HeroID
3. HeroID → heroName
4. HeroID → Weight
5. HeroID → Height
6. HeroID → Affiliations
7. HeroID → Location
8. HeroID → biologicalRace
9. HeroID → heroStatus
10. HeroID → DOB

Decomposition using 3NF Synthesis:

Merge RHS:

1. DOB → Age
2. (DOB, heroName) → HeroID
3. HeroID -> heroName, Weight, Height, Affiliations, Location, biologicalRace, heroStatus, DOB

Set of relations that would result are:

1. R1 (DOB,Age)

2. R2 (DOB, heroName,HeroID)
3. R3 (HeroID, heroName, Weight, Height, Affiliations, Location, biologicalRace, heroStatus, DOB)

Since the attributes (DOB, heroName,HeroID) occur within R3 we don't need to keep R2. Therefore the final relation is:

1. R1 (DOB,Age)
2. R2(HeroID, heroName, Weight, Height, Affiliations, Location, biologicalRace, heroStatus, DOB)

Fight Table

Step 1: Reduce RHS

1. fightTime,location→ winner
2. fightTime,location→ loser
3. fightID → Winner
4. fightID → Loser
5. fightID → Location
6. fightID → fightTime

Step 2: Reduce the LHS - None of them can be reduced

Step 3: Eliminate Redundant FD's

FD	Closure with FD	Closure w/o FD	Result	Final FD
fightTime,location→ winner	fightTime, location, winner	fightTime, location	Keep	fightTime, location→ winner
fightTime,location→ loser	fightTime, location, loser	fightTime ,location	Keep	fightTime, location→ loser
fightID → Winner	fightID, winner, loser, location, fightTime	fightID, winner,loser,location,fightTime	Discard	
fightID → Loser	fightID, winner, loser, location, fightTime	fightID, winner, loser, location, fightTime	Discard	
fightID → Location	fightID, winner, loser, location, fightTime	fightID, winner, loser, fightTime	Keep	fightID → Location
fightID → fightTime	fightID, winner, loser ,location, fightTime	fightID, winner,loser,location	Keep	fightID → fightTime

Minimal Cover:

1. fightTime,location→ winner
2. fightTime,location→ loser
3. fightID → Location
4. fightID → fightTime

Decomposition using 3NF Synthesis:

Merge RHS:

1. fightTime, location → winner, loser
2. fightID → fightTime, Location

Set of relations that would result are:

1. R1 (fightTime, location, winner, loser)
2. R2 (fightID, fightTime, Location)

Since none of the relations are repeated this is the final set of relations.

Populated Tables

Hero Table

R (00000,Saitama,70,175,Saitama Group, City Z, Human, 1994-01-01,Alive)

HeroID	heroName	weight	height	Affiliations	Location	biologicalRace	DOB	heroStatus	heroRank_ID
00000	Saitama	70	175	Saitama Group	City Z	Human	1994-01-01	Alive	39
00001	Genos	NULL	178	Saitama Group	City Z	Cyborg	2000-05-07	Injured	14
00002	King	NULL	187	Saitama Group	City M	Human	1990-03-08	Alive	2
00003	Fubuki	NULL	167	Blizzard Group	City A	Human	1996-04-16	Alive	18
00004	Bang	55	165	NULL	City Z	Human	1938-04-21	Alive	3

HeroDobAge Table

R(1994-01-01,25)

DOB	Age
1994-01-01	25
2000-05-07	19
1990-03-08	29
1996-04-16	23
1938-04-21	81

PowerStats Table

R (0000,0,10,10,10,1,00000)

powerStatsID	dex	durability	luck	strength	intelligence	HeroID
0000	0	10	10	10	1	00000
0001	11	10	9	9	10	00001
0002	1	1	15	2	4	00002
0003	1	1	1	1	1	00003
0004	1	2	10	1	15	00004

CanDo Table

R(00000,00)

Hero_ID	ability_ID
00000	00
00000	01
00000	02
00001	02
00001	03
00002	04
00003	05
00004	06

Ability Table

R (00,Immeasurable Physical Prowess)

ability_ID	Ability Name
00	Immeasurable Physical Prowess
01	Supernatural Reflexes and Senses
02	Enhanced Fighting Skill
03	Full Cyborg Weapony
04	Extreme Luck
05	Psychokinesis
06	Superhuman Physical Prowess

WhoFought Table

R(Saitama,Fubuki, City A, 15:03)

Winner	Loser	Location	fightTime
Saitama	Fubuki	City A	15:03
Saitama	Genos	City D	22:00
Fubuki	King	City C	12:00
Genos	Fubuki	City D	13:00
Genos	Saitama	City F	14:00

FightTime Table
R(00,15:03,City A)

fightID	fightTime	Location
00	15:03	City A
01	22:00	City D
02	12:00	City C
03	13:00	City D
04	14:00	City F

Schedule Table
R (0, 01:00, 2019-05-30)

scheduleID	hourSlot	sDate
0	01:00	2019-05-30
1	14:30	2019-06-01
2	12:00	2019-06-15
3	16:00	2019-06-15
4	08:00	2019-07-20

HeroRank Table
R (00000,75,3500)

Hero_ID	heroRank_ID	salary
00000	75	3500
00001	14	150000
00002	2	1000000
00003	18	100000
00004	3	975000

HasEarned

R (00000, 0921, 2019-01-01)

Hero_ID	Medal_ID	mDate
00000	0921	2019-01-01
00001	0156	2010
00002	0878	2018-09-15
00003	0010	2008-02-13
00004	0002	2007-05-06

MedalsHonors

R (0002, Amazing Physical Feats)

Medal_ID	Title
0002	Amazing Physical Feats
0010	Achieving Top 20 in Hero Rankings
0156	Winner of Annual Hero Competition
0878	Achieving Top 5 in Hero Rankings
0921	Defeating Villains

DDL

```
create table Hero (
      Hero_ID           INTEGER,
      heroName          CHAR (30),
      weight            REAL,
      height            REAL,
      Affiliation       CHAR (30),
      Location          CHAR (6),
      biologicalRace    CHAR (7),
      DOB               DATE,
      heroStatus        CHAR (7),
      heroRank_ID       INTEGER NOT NULL,
      CANDIDATE KEYS (heroName), Hero_ID
      PRIMARY KEY (Hero_ID),
      ON DELETE SET NULL,
      FOREIGN KEY (ability) References Ability
      ON DELETE SET NULL
)

create table HeroDobAge (
      DOB   Date,
      Age   INTEGER,
      PRIMARY KEY (DOB),
      FOREIGN KEY (DOB) References Hero (DOB)
      ON DELETE CASCADE
)

create table PowerStats (
      powerStatsID      INTEGER,
      dex               INTEGER,
      durability        INTEGER,
      luck              INTEGER,
      strength          INTEGER,
      intelligence      INTEGER,
      Hero_ID           INTEGER NOT NULL,
      PRIMARY KEY (powerStatsID, Hero_ID),
      FOREIGN KEY (Hero_ID) References Hero
      ON DELETE CASCADE
)

create table CanDo (
      Hero_ID     INTEGER,
      ability_ID  INTEGER,
      PRIMARY KEY (Hero_ID, abilityID),
      FOREIGN KEY (Hero_ID) References Hero
      ON DELETE CASCADE,
      FOREIGN KEY (ability_ID) References Ability
      ON DELETE CASCADE
)
```

```
create table Ability (
      ability_ID  INTEGER,
      abilityName VARCHAR,
      PRIMARY KEY (ability_ID)
)

create table WhoFought (
      Winner      CHAR (30),
      Loser       CHAR (30),
      Location    CHAR (6),
      fightTime   Time,
      FOREIGN KEY (Winner) References Hero (heroName)
      ON DELETE CASCADE,
      FOREIGN KEY (Loser) References Hero (heroName)
      ON DELETE CASCADE,
)

create table FightTime (
      fightID     INTEGER,
      fightTime   Time,
      Location    CHAR (6),
      PRIMARY KEY (fightID),
      FOREIGN KEY (fightTime) References Schedule(hourSlot),
      ON DELETE CASCADE
)

create table Schedule (
      schedule_ID INTEGER,
      hourSlot    CHAR (10),
      sDate       DATE,
      PRIMARY KEY (scheduleID),
)

create table MedalHonors (
      medal_ID    INTEGER,
      title       CHAR(20),
      PRIMARY KEY (medal_ID)
)

create table HasEarnedMedal (
      medal_ID    INTEGER,
      Hero_ID     INTEGER,
      mDate       DATE,
      PRIMARY KEY (Hero_ID, medal_ID),
      FOREIGN KEY (medal_ID) References Hero
      ON DELETE CASCADE,
      FOREIGN KEY (Hero_ID) References Hero
      ON DELETE SET NULL
)
```

```
create table HeroRank (
      salary INTEGER,
      HeroRank_ID INTEGER,
      Hero_ID INTEGER,
      PRIMARY KEY (HeroRank_ID),
      FOREIGN KEY (Hero_ID) References Hero
      ON DELETE SET NULL
)
```