Sinking Ship Studios
COIS 3400
Project
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Table of Contents:

Step 1: Database Backend Overview **2**

Step 2: ER and UML Diagrams **4**

Step 3: Normalization to 3NF **6**

Step 4: Boyce-Codd NF Justification **8**

Step 5: Table Implementation **9**

Step 6: Populate Database with Data **11**

Step 7: Run 5 Useful SQL Queries **12**

Step 8: Optimize for Scale and Efficiency **13**

Step 9: CSV Export Script **14**

Step 1:

Think of a practical application to a database backend, you may research this portion and provide citations within your report. Your proposed application must need a complicated database with at least six tables. Provide a two to three paragraph description of this application. A great example would be an inventory management system backend for a company with multiple products

Massive Multiplayer Online games, (MMO), are games where thousands to millions of players all login and play the same game together in the same session. As such, the computational power required to run these games is absolutely massive and the amount of data that is stored between item, ability, and player information is also on a massive scale.

Blizzard, developer of arguably the world's most popular MMO, “World of Warcraft”, (WOW), released a dev post regarding the change from an older version of world of warcraft to a more recent version, and the difficulty in reverting to previous version of WOW. In the blog post they detailed some of the underlying changes that occured when the switch was made to go to the newer version, including how they would update their database system in order to reduce the space that is “taken up by nothing”. They achieved this by normalizing their databases from update to update and eventually reached the point where they are today, which also makes it impossible to go backwards and run a previous version of WOW on their current servers because of how fundamentally different the data is stored.
(https://worldofwarcraft.com/en-us/news/21881587)

This article posted by Blizzard gives us some insight into how an MMO would store information in a database, and so we thought it would be an interesting idea to create a database system for an MMO. The system that we are developing the backend for is an MMO and we have tables that store all of the basic information required to host and store data for a given fantasy MMO.

We decided that for our project we would attempt to create a system that would attempt to solve the issue of storing tables of data for the calculation of damage and positioning for an online MMO. As well as recording the current state of a character to be reloaded in a future session playing the game.

The tables are as follows:

Account { Username, Email, Password, pID, DOB, Name }
- Allows them to login to the character associated with the account

Player { pID, Name, Class, Level, XP, Health, Mana, Gold, Ability, Item1, Item2 }
- Limited to 2 items and 1 ability
- Allows for data about character customization as well as player levelling progress
- Character's experience is reset to zero when the character gains a level
- Has stats like Health and Mana for real time gameplay
- Allows us to store and remember the state the given character is

Class {Class, Level, Str, Agi, Int, Attack, Defense }
- Stores information about a given class' base stats at a given level
- Stats in this table provide the base stats of a given character
  Ex 'Str' of 10 increases an associated character 100 'Health'

Monster { mID, Name, Description, Attack, Defense, Bounty, Health, Mana, Ability }
- Limited to 1 ability and no items
- Records combat stats for reference in gameplay
- Has stats like Health and Mana for real time gameplay
- Bounty gives the character that slayed the monster that amount of gold and xp. Ex bounty of 10 grants 10 'Gold' AND 10 'XP' on kill

Item { iID, Name, Description, Attack, Defence, Level }
- Provides additional stats that affect a characters stats

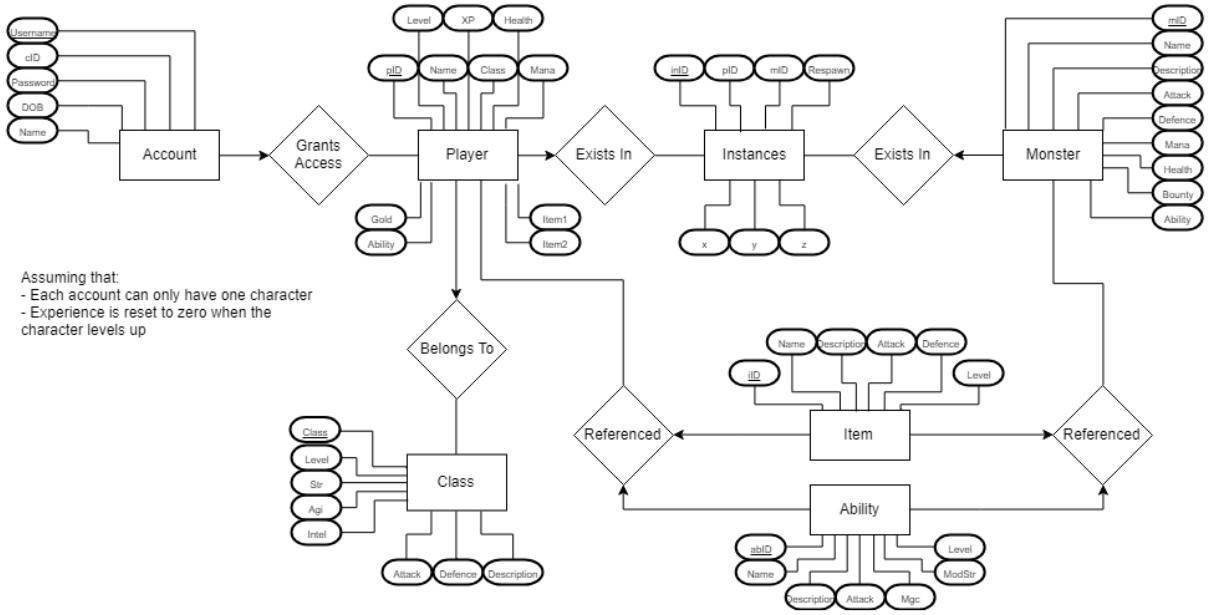
Ability { abID, Name, Description, Attack, Mgc, MgcStr, Level }
- 'Mgc' is a string that refers to an already known effect, and the 'MgcStr' has the damage or effect of that ability.
  Ex 'Mgc' of ice, and 'MgcStr' of 10 does 10 ice damage.

Instances { inID, pID, mID, x, y, z, Respawn }
- Vital to know which characters/monsters to render for every player, acts as a global reference for every players client to know what to render and where
- Monsters and Characters are assigned an 'inID' when they are initialized
- They are then placed into this table to keep track of their 'x', 'y', 'z' coordinates
- As well as a respawn timer if they are dead, to know when they will revive
- The 'cID' and 'mID' fields will be populated with their respective ID, and null otherwise
- When a user logs out of the game their tuple is removed from the table which also means that their character won't be rendered
- The Instances table flushes (removes all entries and repopulates) every 100,000 instance to ensure that the 'inID' value doesn't get too large

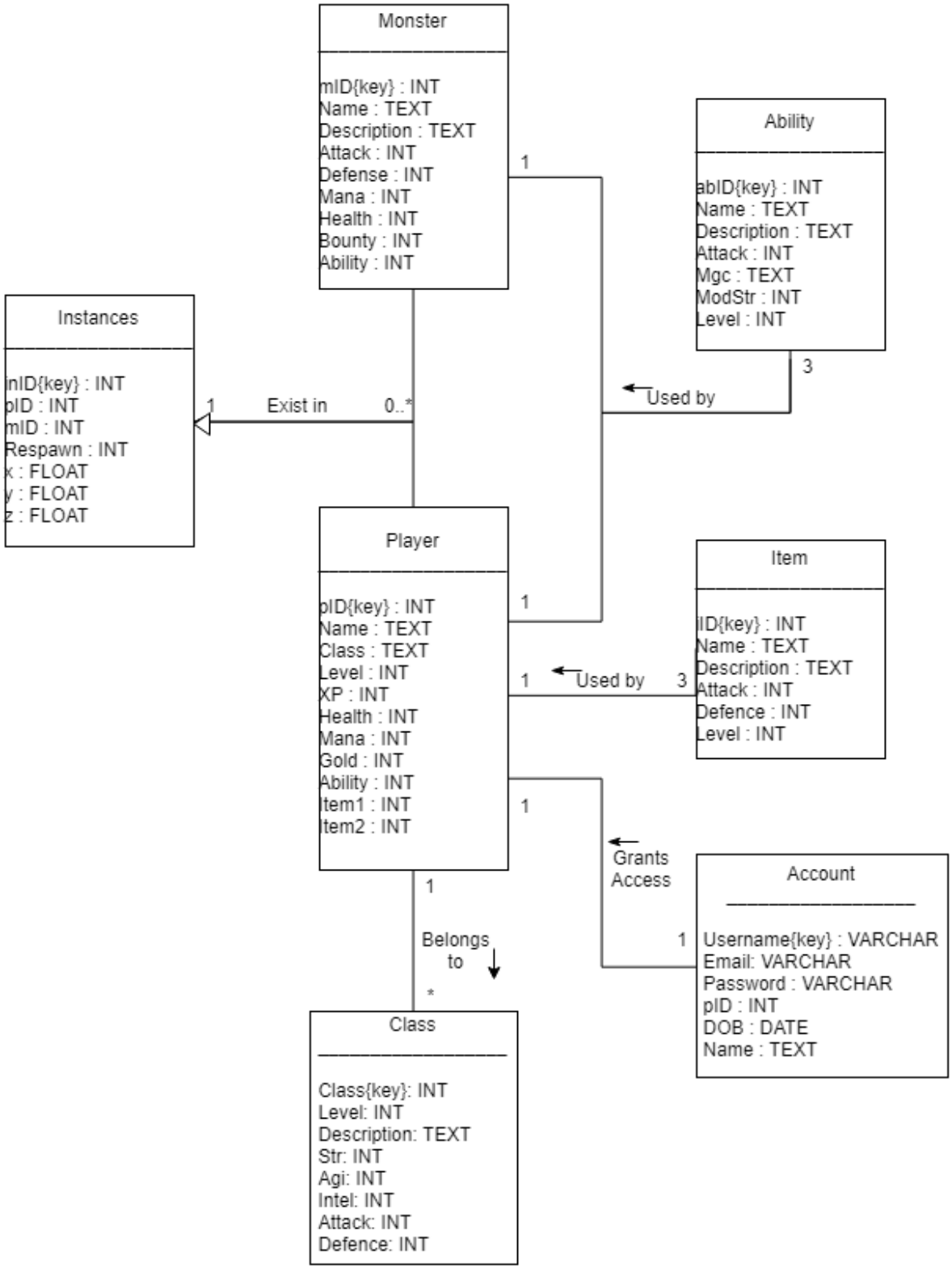
Step 2:

Design the database utilizing an ER diagram (or several if it makes sense to do so), following by that create the UML class diagram for that database. Please include your diagram within your report.

ER Diagram:



UML Diagram:


Monster
mID{key} : INT
Name : TEXT
Description : TEXT
Attack : INT
Defense : INT
Mana : INT
Health : INT
Bounty : INT
Ability : INT
Ability
abID{key} : INT
Name : TEXT
Description : TEXT
Attack : INT
Mgc : TEXT
ModStr : INT
Level : INT
Instances
inID{key} : INT
pID : INT
mID : INT
Respawn : INT
x : FLOAT
y : FLOAT
z : FLOAT
1
Exist in
0..*
1
Used by
3
Player
pID{key} : INT
Name : TEXT
Class : TEXT
Level : INT
XP : INT
Health : INT
Mana : INT
Gold : INT
Ability : INT
Item1 : INT
Item2 : INT
1
1
Used by
3
Item
ID{key} : INT
Name : TEXT
Description : TEXT
Attack : INT
Defence : INT
Level : INT
1
Grants Access
1
Account
Username{key} : VARCHAR
Email: VARCHAR
Password : VARCHAR
pID : INT
DOB : DATE
Name : TEXT
1
Belongs to
*
Class
Class{key}: INT
Level: INT
Description: TEXT
Str: INT
Agi: INT
Intel: INT
Attack: INT
Defence: INT

Step 3:

Analyze the database for performance and redundancy (this means you need to ensure your database is in 3NF). Include the analysis within your report. If it does not make sense to go all the way up to 3NF justify why.

Account { Username, Email, Password, cID, DOB, Name }
1NF: Rows are uniquely identified
Each cell only has 1 value
2NF: Is in 1NF
Each non-key attribute relies fully on the primary key value
3NF: Is in 2NF
No transitive dependency
No derived data

Character { cID, Name, Class, Level, XP, Health, Mana, Gold, Ability, Item1, Item2 }
1NF: Rows are uniquely identified
Each cell only has 1 value
2NF: Is in 1NF
Each non-key attribute relies fully on the primary key value
3NF: Is in 2NF
No transitive dependency
No derived data

Class { Class, Level, Str, Agi, Intel, Attack, Defense }
1NF: Rows are uniquely identified
Each cell only has 1 value
2NF: Is in 1NF
Each non-key attribute relies fully on the primary key value
3NF: Is in 2NF
No transitive dependency
No derived data

Monster { mID, Name, Description, Attack, Defense, Bounty, Level, Health, Mana, Ability }
1NF: Rows are uniquely identified
Each cell only has 1 value
2NF: Is in 1NF
Each non-key attribute relies fully on the primary key value
3NF: Is in 2NF
No transitive dependency
No derived data

Item { iID, Name, Description, Attack, Defense, Level }
1NF: Rows are uniquely identified
Each cell only has 1 value
2NF: Is in 1NF
Each non-key attribute relies fully on the primary key value
3NF: Is in 2NF
No transitive dependency
No derived data

Ability { abID, Name, Description, Attack, Mgc, MgcStr, Level }
1NF: Rows are uniquely identified
Each cell only has 1 value
2NF: Is in 1NF
Each non-key attribute relies fully on the primary key value
3NF: Is in 2NF
No transitive dependency
No derived data

Instances { inID, cID, mID, x, y, z, Respawn }
1NF: Rows are uniquely identified
Each cell only has 1 value
2NF: Is in 1NF
Each non-key attribute relies fully on the primary key value
3NF: Is in 2NF
No transitive dependency
No derived data

Every table meets requirements to be in 3NF

Step 4:

Analyze whether or not the database is in Boyce–Codd normal form, if it is not then why not? Would you benefit from the database being in Boyce-Codd normal form? Justify your answer. Include this within your report.

Given that there are no tables that include functional dependencies and that the tables are all already in 3NF, our database is in Boyce-Codd normal form.

Boyce-Codd normal form can essentially be boiled down to a schema being in 3NF and not having any overlapping candidate keys. Because each attribute represented in our tables has no dependency on any key other than the primary key, we can assume that there are no overlapping candidate keys, and then we already know the table is already in 3NF. So it is in BCNF

Step 5:

Implement the database. Include the code within your report (with screenshots if applicable).

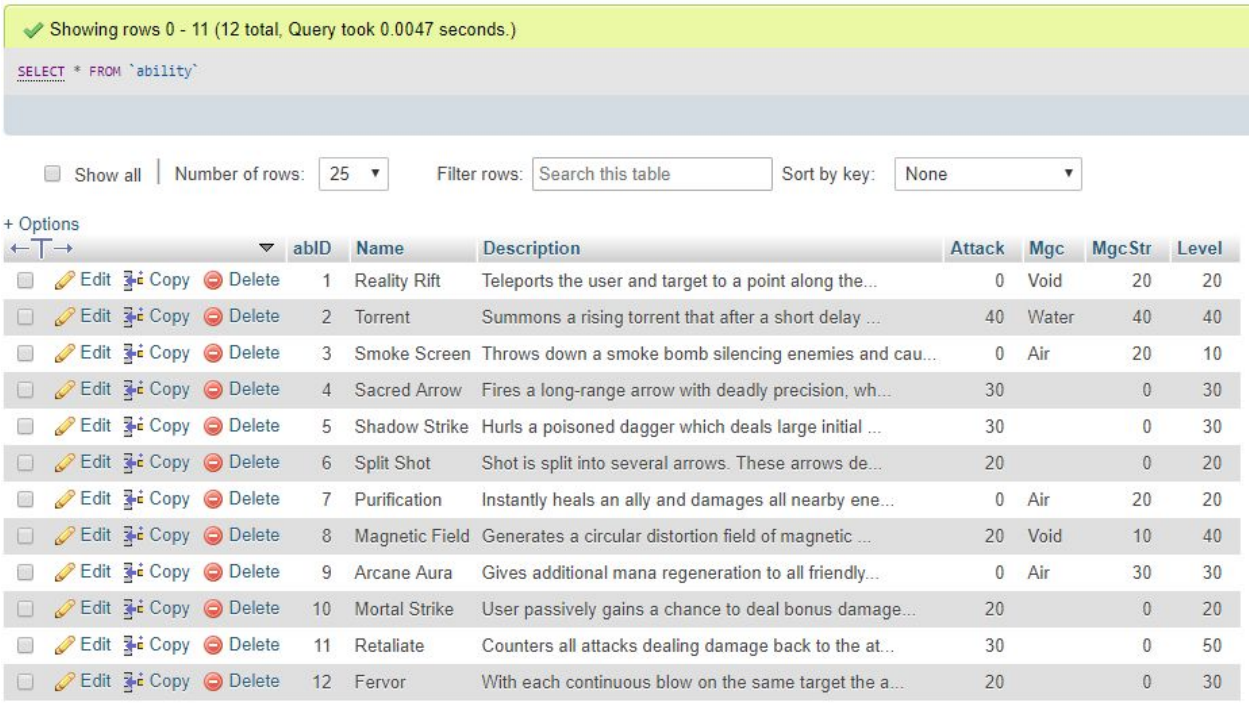
```
CREATE DATABASE Project;

CREATE TABLE account (
    Username varchar(255),
    Email varchar(255) NOT NULL,
    Password varchar(255) NOT NULL,
    pID INT NOT NULL,
    DOB DATE NOT NULL,
    Name TEXT NOT NULL,
    UNIQUE (Username, Email, pID),
    PRIMARY KEY (Username));

CREATE TABLE player (
    pID INT(11) NOT NULL AUTO_INCREMENT,
    Name TEXT,
    Class TEXT,
    Level INT DEFAULT 0,
    XP INT,
    Health INT,
    Mana INT,
    Gold INT,
    Ability INT,
    Item1 INT,
    Item2 INT,
    UNIQUE (pID),
    PRIMARY KEY (pID));

CREATE TABLE Class (
    Class INT(11) NOT NULL AUTO_INCREMENT,
    Description TEXT,
    Level INT,
    Str INT,
    Agi INT,
    Intel INT,
    Attack INT,
    Defence INT,
    UNIQUE (Class),
    PRIMARY KEY (Class));
```

```
CREATE TABLE Monster (          mID INT(11) NOT NULL AUTO_INCREMENT,
                                Name TEXT,
                                Description TEXT,
                                Attack INT,
                                Defence INT,
                                Mana INT,
                                Health INT,
                                Bounty INT,
                                Ability INT,
                                UNIQUE (mID),
                                PRIMARY KEY (mID));

CREATE TABLE Item (             iID INT(11) NOT NULL AUTO_INCREMENT,
                                Name TEXT,
                                Description TEXT,
                                Attack INT,
                                Defence INT,
                                Level INT,
                                UNIQUE (iID),
                                PRIMARY KEY (iID));

CREATE TABLE Ability (          abID INT(11) NOT NULL AUTO_INCREMENT,
                                Name TEXT,
                                Description TEXT,
                                Attack INT,
                                Mgc TEXT,
                                MgcStr INT,
                                Level INT,
                                UNIQUE (abID),
                                PRIMARY KEY (abID));

CREATE TABLE Instances (        inID INT(11) NOT NULL AUTO_INCREMENT,
                                pID INT,
                                mID INT,
                                x FLOAT,
                                y FLOAT,
                                z FLOAT,
                                Respawn INT,
                                UNIQUE (inID),
                                PRIMARY KEY (inID));
```

Step 6:

Populate the database utilizing some mock data. This can be obtained from websites such as Mockaroo (https://www.mockaroo.com/). Show proof of this utilizing a screenshot that is included in your report.

Ability:



Showing rows 0 - 11 (12 total, Query took 0.0047 seconds.)

```
SELECT * FROM `ability`
```

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

+ Options

	abID	Name	Description	Attack	Mgc	MgcStr	Level
Edit Copy Delete	1	Reality Rift	Teleports the user and target to a point along the...	0	Void	20	20
Edit Copy Delete	2	Torrent	Summons a rising torrent that after a short delay ...	40	Water	40	40
Edit Copy Delete	3	Smoke Screen	Throws down a smoke bomb silencing enemies and cau...	0	Air	20	10
Edit Copy Delete	4	Sacred Arrow	Fires a long-range arrow with deadly precision, wh...	30		0	30
Edit Copy Delete	5	Shadow Strike	Hurls a poisoned dagger which deals large initial ...	30		0	30
Edit Copy Delete	6	Split Shot	Shot is split into several arrows. These arrows de...	20		0	20
Edit Copy Delete	7	Purification	Instantly heals an ally and damages all nearby ene...	0	Air	20	20
Edit Copy Delete	8	Magnetic Field	Generates a circular distortion field of magnetic ...	20	Void	10	40
Edit Copy Delete	9	Arcane Aura	Gives additional mana regeneration to all friendly...	0	Air	30	30
Edit Copy Delete	10	Mortal Strike	User passively gains a chance to deal bonus damage...	20		0	20
Edit Copy Delete	11	Retaliate	Counters all attacks dealing damage back to the at...	30		0	50
Edit Copy Delete	12	Fervor	With each continuous blow on the same target the a...	20		0	30

Ability names and descriptions were taken from Dota 2 http://www.dota2.com/heroes/.

Account:

Showing rows 0 - 24 (1000 total, Query took 0.0077 seconds.)

```
SELECT * FROM `account`
```

1 > >> | Number of rows: 25 Filter rows: Search this table Sort by key: None

+ Options

	Username	Email	Password	pID	DOB	Name
Edit Copy Delete	aannattgx	aannattgx@marriott.com	AtGtbH0Nu4GJ	610	2002-08-04	Ash Annatt
Edit Copy Delete	aanwelllw	aanwelllw@exblog.jp	UDoW4rv6i	789	2007-09-04	Annelise Anwell
Edit Copy Delete	abarbourav	abarbourav@tiny.cc	f73c2scb62BL	392	2011-04-19	Arden Barbour
Edit Copy Delete	abarracloughcx	abarracloughcx@marketwatch.com	MazRL7	466	1991-04-02	Adda Barraclough
Edit Copy Delete	abarriballgr	abarriballgr@utexas.edu	rEGbwHJY	604	1992-05-24	April Barriball
Edit Copy Delete	abattlesonmk	abattlesonmk@weibo.com	zh9wyM	813	1985-05-15	Ash Battleson
Edit Copy Delete	abedboroi2	abedboroi2@oakley.com	eXB2jV2XT	651	2009-08-19	Arnie Bedboro
Edit Copy Delete	abisley6o	abisley6o@imgur.com	zAYuV0ylnUvs	241	1990-01-08	Aurlie Bisley
Edit Copy Delete	abogart65	abogart65@ucsd.edu	RlqEgaB5	222	2000-12-19	Almeria Bogart
Edit Copy Delete	abonifacio3i	abonifacio3i@tinypic.com	bOkF8eITA	127	1984-08-31	Arri Bonifacio
Edit Copy Delete	abrabben25	abrabben25@bravesites.com	vVHV42b	78	2001-07-25	Angus Brabben
Edit Copy Delete	abraggintonqj	abraggintonqj@bandcamp.com	XseEFHdQ	956	1998-06-23	Alanah Bragginton
Edit Copy Delete	abraunstonm2	abraunstonm2@ycombinator.com	VcmfFY	795	2005-07-17	Almeta Braunston
Edit Copy Delete	abrinklowei	abrinklowei@fc2.com	ftbSEQ1	523	1997-07-21	Ariel Brinklow
Edit Copy Delete	abruggenca	abruggenca@google.com.hk	UcPFebY	443	2000-02-29	Alexia Bruggen
Edit Copy Delete	abunsonja	abunsonja@simplemachines.org	2FUO405	695	2000-09-01	Anetta Bunson
Edit Copy Delete	acanelasok	acanelasok@sfgate.com	MhYy6kMNo0TD	885	1994-10-17	Agathe Canelas
Edit Copy Delete	acapelin2d	acapelin2d@chicagotribune.com	usZQUd	86	1988-03-30	Anya Capelin
Edit Copy Delete	acatteroll3c	acatteroll3c@umich.edu	8IO3lawWMI4R	121	2001-03-18	Almire Catteroll
Edit Copy Delete	acesconld	acesconld@eventbrite.com	d8rZFri4	770	1994-08-04	Abra Cescon
Edit Copy Delete	achippsen	achippsen@etsy.com	P1iUe77v5w	528	2009-12-23	Amelita Chipps
Edit Copy Delete	acocciib	acocciib@yale.edu	JzHeepho	660	1998-03-26	Ainslie Cocci
Edit Copy Delete	acowthardmn	acowthardmn@oaic.gov.au	af5CdWDhRt	816	1998-07-09	Anissa Cowthard
Edit Copy Delete	acraisfordpo	acraisfordpo@spotify.com	CxdbX4aaHOa	925	2012-01-19	Ailsun Craisford
Edit Copy Delete	acundek9	acundek9@shinystat.com	EP4wCOiLE	730	1997-11-23	Aaron Cunde

Class:

Showing rows 0 - 11 (12 total, Query took 0.0048 seconds.)

```
SELECT * FROM `class`
```

Show all | Number of rows: 25 | Filter rows: Search this table | Sort by key:

+ Options

	Class	Description	Level	Str	Agi	Intel	Attack	Defence
Edit Copy Delete	1	archer	1	7	7	6	20	15
Edit Copy Delete	2	archer	2	10	11	9	25	20
Edit Copy Delete	3	archer	3	17	20	13	35	30
Edit Copy Delete	4	healer	1	5	6	9	10	20
Edit Copy Delete	5	healer	2	7	9	14	15	25
Edit Copy Delete	6	healer	3	14	16	20	20	30
Edit Copy Delete	7	mage	1	4	7	9	20	20
Edit Copy Delete	8	mage	2	8	9	13	25	25
Edit Copy Delete	9	mage	3	16	14	20	35	35
Edit Copy Delete	10	warrior	1	10	5	5	25	20
Edit Copy Delete	11	warrior	2	14	7	8	30	25
Edit Copy Delete	12	warrior	3	20	16	14	40	35

Instances:

Showing rows 0 - 24 (1000 total, Query took 0.0092 seconds.)

```
SELECT * FROM `instances`
```

1 > >> | Number of rows: 25 Filter rows: Search this table

+ Options

	inID	pID	mID	x	y	z	Respawn
Edit Copy Delete	1	0	2	312	28	766	97
Edit Copy Delete	2	0	2	929	48	606	129
Edit Copy Delete	3	0	6	305	43	238	92
Edit Copy Delete	4	321	0	52	1	537	0
Edit Copy Delete	5	0	1	165	40	412	88
Edit Copy Delete	6	0	9	419	42	284	195
Edit Copy Delete	7	0	6	849	51	24	87
Edit Copy Delete	8	0	8	729	75	705	85
Edit Copy Delete	9	859	0	490	25	394	0
Edit Copy Delete	10	0	2	203	21	473	53
Edit Copy Delete	11	0	9	926	31	687	56
Edit Copy Delete	12	0	8	809	77	261	67
Edit Copy Delete	13	0	7	635	74	492	124
Edit Copy Delete	14	0	6	843	87	338	138
Edit Copy Delete	15	868	0	182	18	939	0
Edit Copy Delete	16	795	0	288	67	744	0
Edit Copy Delete	17	518	0	639	98	232	0
Edit Copy Delete	18	0	9	520	19	466	171
Edit Copy Delete	19	451	0	296	48	875	0
Edit Copy Delete	20	807	0	96	36	90	0
Edit Copy Delete	21	0	4	258	34	136	70
Edit Copy Delete	22	48	0	73	29	969	0
Edit Copy Delete	23	0	4	234	53	20	52
Edit Copy Delete	24	0	1	743	18	766	163
Edit Copy Delete	25	0	10	441	57	303	178

Item:

Showing rows 0 - 14 (15 total, Query took 0.0124 seconds.)

```
SELECT * FROM `item`
```

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

+ Options

	iID	Name	Description	Attack	Defence	Level
Edit Copy Delete	1	Mana Potion	Restores 20 mana. Mint green with blue flecks and ...	0	0	10
Edit Copy Delete	2	Health Potion	Restores 20 health. White with yellow-orange swirl...	0	0	10
Edit Copy Delete	3	Strength Potion	Temporarily raises strength by 5. Sapphire with da...	0	0	20
Edit Copy Delete	4	Agility Potion	Temporarily increases agility by 5. Opalescent whi...	0	0	20
Edit Copy Delete	5	Intelligence Potion	Temporarily increases intelligence by 5. Copper wi...	0	0	20
Edit Copy Delete	6	Collector's Charm	Increases monster's bounty by 10% and slightly inc...	0	0	30
Edit Copy Delete	7	Warrior's Charm	Increases warrior's attack by 20%. A lead charm wi...	20	10	20
Edit Copy Delete	8	Healer's Charm	Increases intelligence by 20%. A very large emeral...	0	10	20
Edit Copy Delete	9	Archer's Charm	Increases archer's attack by 20%. A dark bronze ch...	20	0	20
Edit Copy Delete	10	Mage's Charm	Increases mage's max mana by 20. A small garnet ch...	0	0	20
Edit Copy Delete	11	Handaxe	This handaxe was forged by a long-dead hero and is...	30	0	30
Edit Copy Delete	12	Armour	This suit of armor is traditionally used by rebels...	0	30	10
Edit Copy Delete	13	Compound Bow	This compound bow was forged by witches entirely b...	20	0	30
Edit Copy Delete	14	Staff	This staff looks slightly different based on who o...	20	10	30
Edit Copy Delete	15	Longsword	This longsword always feels cold to the touch. The...	20	0	20

Monster:

Showing rows 0 - 4 (5 total, Query took 0.0055 seconds.)

```
SELECT * FROM `monster`
```

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

+ Options

	mID	Name	Description	Attack	Defence	Mana	Health	Bounty	Ability
Edit Copy Delete	1	Helen	This enormous furred monster lairs in coastal area...	20	30	100	100	30	2
Edit Copy Delete	2	Judy	This massive infernal creature lairs in deep canyo...	30	10	100	100	50	11
Edit Copy Delete	3	Tim	This medium-sized, phantasmal, chimeric creature d...	20	20	100	100	50	12
Edit Copy Delete	4	Norman	This runty phantasmal beast dwells in city sewers....	15	20	100	100	20	1
Edit Copy Delete	5	Robert	This massive humanoid beast makes its home in moun...	10	20	100	100	40	7

Player:

Showing rows 0 - 24 (1000 total, Query took 0.0049 seconds.)

```
SELECT * FROM `player`
```

1 > >> | Number of rows: 25 Filter rows: Search this table Sort by key: None

+ Options

	pID	Name	Class	Level	XP	Health	Mana	Gold	Ability	Item1	Item2
Edit Copy Delete	1	Cherida	healer	14	95	94	44	26	3	7	6
Edit Copy Delete	2	Stacie	mage	32	24	76	24	57	11	3	3
Edit Copy Delete	3	Winnah	archer	69	9	45	96	73	11	8	10
Edit Copy Delete	4	Teresina	archer	67	46	75	71	23	3	12	1
Edit Copy Delete	5	Bale	mage	51	34	96	99	39	4	11	10
Edit Copy Delete	6	Morgan	warrior	23	47	44	44	20	7	4	10
Edit Copy Delete	7	Valentijn	warrior	22	62	24	70	62	3	6	1
Edit Copy Delete	8	Clarisse	archer	23	23	36	72	94	11	8	2
Edit Copy Delete	9	Marcelline	mage	30	89	100	73	30	11	2	4
Edit Copy Delete	10	Camile	mage	83	18	53	64	50	1	8	5
Edit Copy Delete	11	Halley	archer	25	37	52	80	93	11	4	8
Edit Copy Delete	12	Tiffanie	archer	27	55	86	35	59	12	5	2
Edit Copy Delete	13	Ralina	warrior	19	31	59	66	81	11	5	2
Edit Copy Delete	14	Claude	warrior	71	9	42	49	33	2	8	3
Edit Copy Delete	15	Michal	healer	62	87	41	57	94	1	10	10
Edit Copy Delete	16	Daria	archer	63	69	47	33	72	11	12	2
Edit Copy Delete	17	Leland	archer	51	74	32	80	57	11	10	6
Edit Copy Delete	18	Milka	healer	96	4	48	42	98	1	7	6
Edit Copy Delete	19	Dulsea	archer	45	0	29	23	53	8	7	9
Edit Copy Delete	20	Hubie	archer	8	79	62	99	33	2	5	4
Edit Copy Delete	21	Celisse	mage	15	24	43	34	62	4	1	1
Edit Copy Delete	22	Lillian	archer	75	38	0	91	68	3	12	2
Edit Copy Delete	23	Tildie	mage	45	61	95	85	27	2	12	4
Edit Copy Delete	24	Adrianna	archer	7	92	23	36	73	5	9	12
Edit Copy Delete	25	Pail	mage	51	50	0	86	75	3	9	9

Step 7:

Run 5 useful SQL queries depending on your application for this database. Provide the screenshot output and include it in your report.

1. *Select current player health from all instances inside the instances table:*

```
SELECT player.Health
FROM player
INNER JOIN instances
ON player.pID = instances.pID;
```

Health
84
88
64
20
1
71
47
41
55
73
51
42
15
55
13
25
78
1
67
43
86
54
47
62
50

2. *Select player health after a 40 damage attack with defence reduction*

```
SELECT player.Health AS 'BEFORE',
SUM(player.Health - 40 + item.Defence) AS 'AFTER',
player.*
FROM player
INNER JOIN account
ON account.pID = player.pID
INNER JOIN item
ON item.iID = player.Item1
WHERE player.Item1 = 12 OR player.Item2 = 12
GROUP BY player.pID
```

+ Options

BEFORE	AFTER	pID	Name	Class	Level	XP	Health	Mana	Gold	Ability	Item1	Item2
75	65	4	Teresina	archer	67	46	75	71	23	3	12	1
47	37	16	Daria	archer	63	69	47	33	72	11	12	2
0	-10	22	Lillian	archer	75	38	0	91	68	3	12	2
95	85	23	Tildie	mage	45	61	95	85	27	2	12	4
23	-17	24	Adrianna	archer	7	92	23	36	73	5	9	12
39	-1	32	Vanna	archer	52	84	39	80	82	4	2	12
41	31	48	Bunnie	archer	56	43	41	79	2	3	12	10
12	-28	58	Missie	mage	48	3	12	43	91	5	11	12
94	84	64	Hannah	warrior	25	90	94	24	93	2	12	1
36	-4	68	Perl	mage	53	69	36	42	36	1	1	12
64	24	69	Gawen	archer	75	46	64	51	47	10	6	12
84	74	73	Arel	warrior	68	11	84	12	11	3	12	10
37	27	77	Amelita	warrior	5	70	37	34	46	6	12	8
55	45	90	Maurizia	archer	14	9	55	98	89	10	12	10
65	55	102	Brittan	mage	15	46	65	7	0	2	12	7
79	69	105	Emelda	archer	49	54	79	88	72	4	12	9
26	-14	111	Imogene	mage	69	2	26	47	79	11	11	12
3	-7	113	Caitrin	mage	66	62	3	68	50	8	12	7
48	38	133	Antone	healer	27	65	48	31	8	9	12	10
97	57	136	Irwin	warrior	17	15	97	3	27	6	2	12
89	79	139	Mariel	healer	61	32	89	31	34	8	12	12
1	-39	144	Angie	mage	6	34	1	66	46	6	3	12
10	-30	163	Sibby	warrior	48	6	10	3	15	8	2	12
63	23	168	Reba	archer	97	86	63	66	72	9	5	12
99	59	171	Chas	mage	12	62	99	0	39	10	4	12

3. *Show all monsters that are in raised terrain areas and display their position*

```
SELECT monster.Name, instances.x, instances.y, instances.z
FROM monster
INNER JOIN instances
ON instances.mID = monster.mID
WHERE instances.y > 20;
```

Name	x	y ▲ 1	z
Judy	203	21	473
Tim	303	21	701
Judy	885	23	296
Tim	692	23	85
Judy	834	24	384
Judy	871	24	844
Judy	306	24	597
Judy	844	24	71
Judy	315	24	179
Robert	185	25	995
Robert	848	25	324
Helen	712	26	214
Tim	674	26	995
Norman	834	26	874
Robert	142	26	671
Helen	293	27	671
Helen	203	27	884
Judy	312	28	766
Judy	183	28	540
Tim	374	28	773
Norman	110	28	715
Robert	534	28	144
Tim	313	29	203
Robert	206	29	353
Norman	561	30	171

4. *Display the abilities and which monsters use which ability*

```
SELECT Ability.*, Monster.Name
FROM Ability
LEFT JOIN Monster
ON Ability.abID = Monster.Ability;
```

abID	Name	Description	Attack	Mgc	MgcStr	Level	Name
2	Torrent	Summons a rising torrent that after a short delay ...	40	Water	40	40	Helen
11	Retaliate	Counters all attacks dealing damage back to the at...	30		0	50	Judy
12	Fervor	With each continuous blow on the same target the a...	20		0	30	Tim
1	Reality Rift	Teleports the user and target to a point along the...	0	Void	20	20	Norman
7	Purification	Instantly heals an ally and damages all nearby ene...	0	Air	20	20	Robert
3	Smoke Screen	Throws down a smoke bomb silencing enemies and cau...	0	Air	20	10	NULL
4	Sacred Arrow	Fires a long-range arrow with deadly precision, wh...	30		0	30	NULL
5	Shadow Strike	Hurls a poisoned dagger which deals large initial ...	30		0	30	NULL
6	Split Shot	Shot is split into several arrows. These arrows de...	20		0	20	NULL
8	Magnetic Field	Generates a circular distortion field of magnetic ...	20	Void	10	40	NULL
9	Arcane Aura	Gives additional mana regeneration to all friendly...	0	Air	30	30	NULL
10	Mortal Strike	User passively gains a chance to deal bonus damage...	20		0	20	NULL

5. *Find damage dealt with a magical ability from different players:*

```
SELECT player.pID, player.Name, SUM(ability.MgcStr + class.Intel) AS Damage
FROM player
INNER JOIN class
ON player.Class = class.Description
INNER JOIN ability
ON player.Ability = ability.abID
GROUP BY pID
```

pID	Name	Damage
1	Cherida	103
2	Stacie	42
3	Winnah	28
4	Teresina	88
5	Bale	42
6	Morgan	87
7	Valentijn	87
8	Clarisse	28
9	Marcelline	42
10	Camile	102
11	Halley	28
12	Tiffanie	28
13	Ralina	27
14	Claude	147
15	Michal	103
16	Daria	28
17	Leland	28
18	Milka	103
19	Dulsea	58
20	Hubie	148
21	Celisse	42
22	Lillian	88
23	Tildie	162
24	Adrianna	28
25	Pail	102

Step 8:

Research how to make the database more efficient for scale and write a two to three paragraph description of what you found when you completed your research (please ensure that you cite credible sources).

Scalability became an issue for databases when cloud architecture became more common, specifically for relational databases. There are multiple techniques that can be used to increase database capacity. The first is to have multiple read replicas of the on different servers, along with a master that accepts both read and write requests. This technique is good for databases that require lots of read requests, and allows for the master to fail since the replicas are exact copies and can replace the master. If there are many write requests, a multi-master technique can be used to allow any client to write data to any available server. This differs from the previous technique such that the replicas are actually masters themselves so the number of reads and writes the system can handle is larger.

Some databases may be so large that just one server will not be able to access and modify data with good performance, so a technique called partitioning may be used instead of multi-masters or replicas. This involves splitting the data up in a logical way. Partitioning may be done horizontally or vertically and allows the database and cache to manage less information at one time. Horizontal partitioning, also known as sharding, is when data is distributed among several servers, and vertical partitioning is when certain data is grouped into frequently accessed and rarely accessed. Another alternative is to forgo relational databases and use a NoSQL system. NoSQL systems are better when it comes to systems that involve massive amounts of rapidly changing data.

References

RealScale Architecture from Cloud 66, “Database Server Scaling Strategies,” *realscale.cloud66.com.* [Online]. Available: http://realscale.cloud66.com/database-server-scaling-strategies/ [Accessed Nov. 30, 2018]

mongoDB. “NoSQL Databases Explained,” *mongoDB.* [Online]. Available: https://www.mongodb.com/nosql-explained [Accessed Nov. 30, 2018]

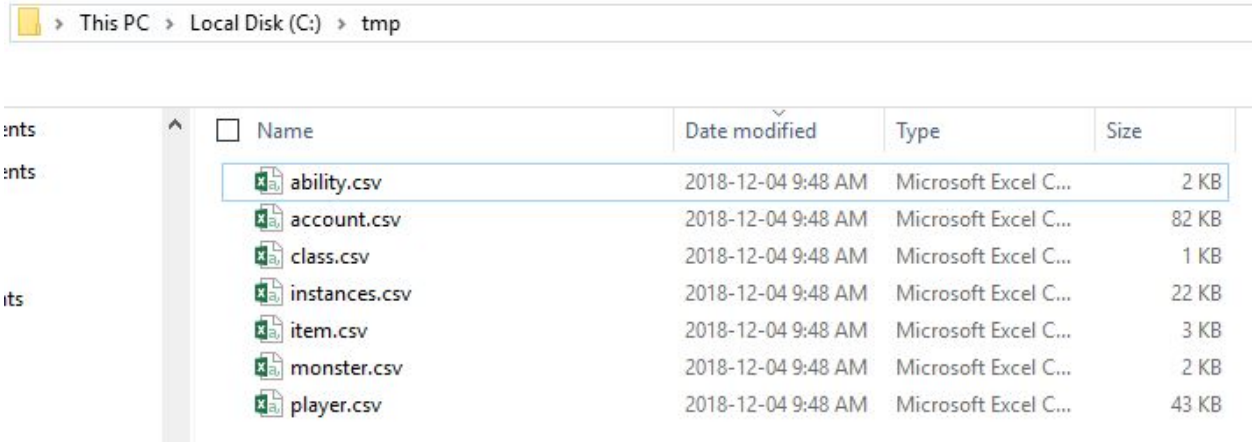
Step 9:

One of the most common scripts required for a database job is to export that database to a CSV or a text file. Write a script in any language that will do this, include the code in your submission.

Main.Java

```
import java.sql.*;
import static java.sql.DriverManager.getConnection;

public class Main {

   private static Statement statement;

   public static void main(String[] args) throws Exception {
       Connection connect = getConnection("jdbc:mysql://localhost/projectli", "root", "");
       statement = connect.createStatement();
       export(statement);
   }

   public static void export(Statement statement) throws Exception {

        // ability
        statement.executeQuery("SELECT * FROM ability INTO OUTFILE '/tmp/ability.csv'
        FIELDS TERMINATED BY ',' ENCLOSED BY '\"' LINES TERMINATED BY '\n'");

        // account
        statement.executeQuery("SELECT * FROM account INTO OUTFILE '/tmp/account.csv'
        FIELDS TERMINATED BY ',' ENCLOSED BY '\"' LINES TERMINATED BY '\n'");

        // class
        statement.executeQuery("SELECT * FROM class INTO OUTFILE '/tmp/class.csv' FIELDS
        TERMINATED BY ',' ENCLOSED BY '\"' LINES TERMINATED BY '\n'");

        // instances
        statement.executeQuery("SELECT * FROM instances INTO OUTFILE '/tmp/instances.csv'
        FIELDS TERMINATED BY ',' ENCLOSED BY '\"' LINES TERMINATED BY '\n'");

        // item
        statement.executeQuery("SELECT * FROM item INTO OUTFILE '/tmp/item.csv' FIELDS
        TERMINATED BY ',' ENCLOSED BY '\"' LINES TERMINATED BY '\n'");

        // monster
        statement.executeQuery("SELECT * FROM monster INTO OUTFILE '/tmp/monster.csv'
        FIELDS TERMINATED BY ',' ENCLOSED BY '\"' LINES TERMINATED BY '\n'");

        // player
        statement.executeQuery("SELECT * FROM player INTO OUTFILE '/tmp/player.csv' FIELDS
        TERMINATED BY ',' ENCLOSED BY '\"' LINES TERMINATED BY '\n'");
   }
}
```

Output:



ability.csv

1	Reality Rif	Teleports	0	Void	20	20
2	Torrent	Summons	40	Water	40	40
3	Smoke Scr	Throws dc	0	Air	20	10
4	Sacred Arr	Fires a lor	30		0	30
5	Shadow St	Hurls a po	30		0	30
6	Split Shot	Shot is spl	20		0	20
7	Purificatic	Instantly h	0	Air	20	20
8	Magnetic	Generates	20	Void	10	40
9	Arcane Au	Gives add	0	Air	30	30
10	Mortal Str	User passi	20		0	20
11	Retaliate	Counters a	30		0	50
12	Fervor	With each	20		0	30

account.csv

aannattgx	aannattgx	AtGtbH0N	610	########	Ash Annatt
aanwelllw	aanwelllw	UDoW4rv(	789	########	Annelise Anwell
abarboura	abarboura	f73c2scb6	392	########	Arden Barbour
abarraclou	abarraclou	MazRL7	466	########	Adda Barraclough
abarriball	abarriball	rEGbwHJY	604	########	April Barriball
abattleson	abattleson	zh9wyM	813	########	Ash Battleson
abedboro	abedboro	eXB2jV2X	651	########	Arnie Bedboro
abisley6o	abisley6o	zAYuV0yIr	241	########	Aurlie Bisley
abogart65	abogart65	RlqEgaB5	222	########	Almeria Bogart
abonifacio	abonifacio	bOkF8eIT/	127	########	Arri Bonifacio
abrabben1	abrabben1	vVHV42b	78	########	Angus Brabben
abragginto	abragginto	XseEFHdC	956	########	Alanah Bragginton
abraunsto	abraunsto	VcmfFY	795	########	Almeta Braunston
abrinklow	abrinklow	ftbSEQ1	523	########	Ariel Brinklow
abruggeno	abruggeno	UcPFebY	443	########	Alexia Bruggen
abunsonja	abunsonja	2FUO405	695	########	Anetta Bunson
acanelaso	acanelaso	MhYy6kM	885	########	Agathe Canelas
acapelin2	acapelin2	usZQUd	86	########	Anya Capelin
acatteroll	acatteroll	8lO3IawW	121	########	Almire Catteroll
acesconld	acesconld	d8rZFri4	770	########	Abra Cescon
achippser	achippser	P1iUe77v5	528	########	Amelita Chipps
acocciib	acocciib@	JzHeepho	660	########	Ainslie Cocci
acowthard	acowthard	af5CdWDh	816	########	Anissa Cowthard
acraisford	acraisford	CxdbX4aa	925	########	Ailsun Craisford
acundek9	acundek9	EP4wCOiL	730	########	Aaron Cunde
acurtayne	acurtayne	0fQVsW	115	########	Alwin Curtayne
adevenny	adevenny	bxmm6QF	757	########	Arvy Devenny
aduckinfie	aduckinfie	C59wBBa	262	########	Angeli Duckinfield
adwireos	adwireos(	hzBok76K	893	########	Ainslee Dwire
aeschalot	aeschalot	jlBUvd7	477	########	Annette Eschalotte
aeuesden	aeuesden	iqZDsJQTc	91	########	Alex Euesden
aeymordl	aeymordl	UazsNLO	490	########	Augustus Eymor
afarndale	afarndale	oB805PP	854	########	Ara Farndale
afickengp	afickengp	DtfaUNFO	602	########	Andrew Ficken
aforre9t	aforre9t@	SVpwso4	354	########	Aurie Forre
afosdykel	afosdykel	zbBBKBkr	772	########	Adair Fosdyke
afuentecc	afuentecc	GBs2RHvn	459	########	Agustin Fuente
agaddm6	agaddm6(	eq7QczYzl	799	########	Ade Gadd

class.csv

1	archer	1	7	7	6	20	15
2	archer	2	10	11	9	25	20
3	archer	3	17	20	13	35	30
4	healer	1	5	6	9	10	20
5	healer	2	7	9	14	15	25
6	healer	3	14	16	20	20	30
7	mage	1	4	7	9	20	20
8	mage	2	8	9	13	25	25
9	mage	3	16	14	20	35	35
10	warrior	1	10	5	5	25	20
11	warrior	2	14	7	8	30	25
12	warrior	3	20	16	14	40	35

item.csv

1	Mana Poti	Restores 2	0	0	10
2	Health Po	Restores 2	0	0	10
3	Strength F	Temporar	0	0	20
4	Agility Po	Temporar	0	0	20
5	Intelligen	Temporar	0	0	20
6	Collector'	Increases	0	0	30
7	Warrior's	Increases	20	10	20
8	Healer's C	Increases	0	10	20
9	Archer's C	Increases	20	0	20
10	Mage's Ch	Increases	0	0	20
11	Handaxe	This hand	30	0	30
12	Armour	This suit o	0	30	10
13	Compoun	This comp	20	0	30
14	Staff	This staff	20	10	30
15	Longswor	This longs	20	0	20

monster.csv

1	Helen	This enorr	20	30	100	100	30	2
2	Judy	This massi	30	10	100	100	50	11
3	Tim	This medi	20	20	100	100	50	12
4	Norman	This runty	15	20	100	100	20	1
5	Robert	This massi	10	20	100	100	40	7

instances.csv

1	0	2	312	28	766	97
2	0	2	929	48	606	129
3	0	6	305	43	238	92
4	321	0	52	1	537	0
5	0	1	165	40	412	88
6	0	9	419	42	284	195
7	0	6	849	51	24	87
8	0	8	729	75	705	85
9	859	0	490	25	394	0
10	0	2	203	21	473	53
11	0	9	926	31	687	56
12	0	8	809	77	261	67
13	0	7	635	74	492	124
14	0	6	843	87	338	138
15	868	0	182	18	939	0
16	795	0	288	67	744	0
17	518	0	639	98	232	0
18	0	9	520	19	466	171
19	451	0	296	48	875	0
20	807	0	96	36	90	0
21	0	4	258	34	136	70
22	48	0	73	29	969	0
23	0	4	234	53	20	52
24	0	1	743	18	766	163
25	0	10	441	57	303	178
26	966	0	185	0	667	0
27	0	3	360	67	103	128
28	899	0	279	57	141	0
29	0	2	180	62	512	111
30	497	0	808	40	88	0
31	847	0	522	19	306	0
32	725	0	479	82	18	0
33	0	10	403	36	678	180
34	0	2	422	12	503	141
35	652	0	570	48	227	0
36	0	10	904	29	74	169
37	978	0	591	27	789	0
38	0	6	621	52	6	153

player.csv

1	Cherida	healer	14	95	94	44	26	3	7	6
2	Stacie	mage	32	24	76	24	57	11	3	3
3	Winnah	archer	69	9	45	96	73	11	8	10
4	Teresina	archer	67	46	75	71	23	3	12	1
5	Bale	mage	51	34	96	99	39	4	11	10
6	Morgan	warrior	23	47	44	44	20	7	4	10
7	Valentijn	warrior	22	62	24	70	62	3	6	1
8	Clarisse	archer	23	23	36	72	94	11	8	2
9	Marcellin	mage	30	89	100	73	30	11	2	4
10	Camile	mage	83	18	53	64	50	1	8	5
11	Halley	archer	25	37	52	80	93	11	4	8
12	Tiffanie	archer	27	55	86	35	59	12	5	2
13	Ralina	warrior	19	31	59	66	81	11	5	2
14	Claude	warrior	71	9	42	49	33	2	8	3
15	Michal	healer	62	87	41	57	94	1	10	10
16	Daria	archer	63	69	47	33	72	11	12	2
17	Leland	archer	51	74	32	80	57	11	10	6
18	Milka	healer	96	4	48	42	98	1	7	6
19	Dulsea	archer	45	0	29	23	53	8	7	9
20	Hubie	archer	8	79	62	99	33	2	5	4
21	Celisse	mage	15	24	43	34	62	4	1	1
22	Lillian	archer	75	38	0	91	68	3	12	2
23	Tildie	mage	45	61	95	85	27	2	12	4
24	Adrianna	archer	7	92	23	36	73	5	9	12
25	Pail	mage	51	50	0	86	75	3	9	9
26	Rheba	archer	27	41	17	68	69	7	7	2
27	Lib	healer	66	59	23	20	91	8	8	10
28	Blithe	warrior	24	71	0	58	35	6	7	3
29	Ingeberg	archer	65	38	30	33	64	11	8	10
30	Catina	mage	22	69	21	78	76	8	4	7
31	Yoko	healer	58	2	95	4	29	10	8	9
32	Vanna	archer	52	84	39	80	82	4	2	12
33	Starlin	archer	57	15	14	57	90	5	4	4
34	Margaret	healer	41	46	9	49	8	7	1	6
35	Dukie	mage	83	97	48	33	34	4	7	7
36	Chantalle	archer	82	46	33	80	31	1	2	11
37	Ellissa	warrior	77	81	77	77	82	1	10	7
38	Stanfield	archer	85	53	43	53	0	2	4	10