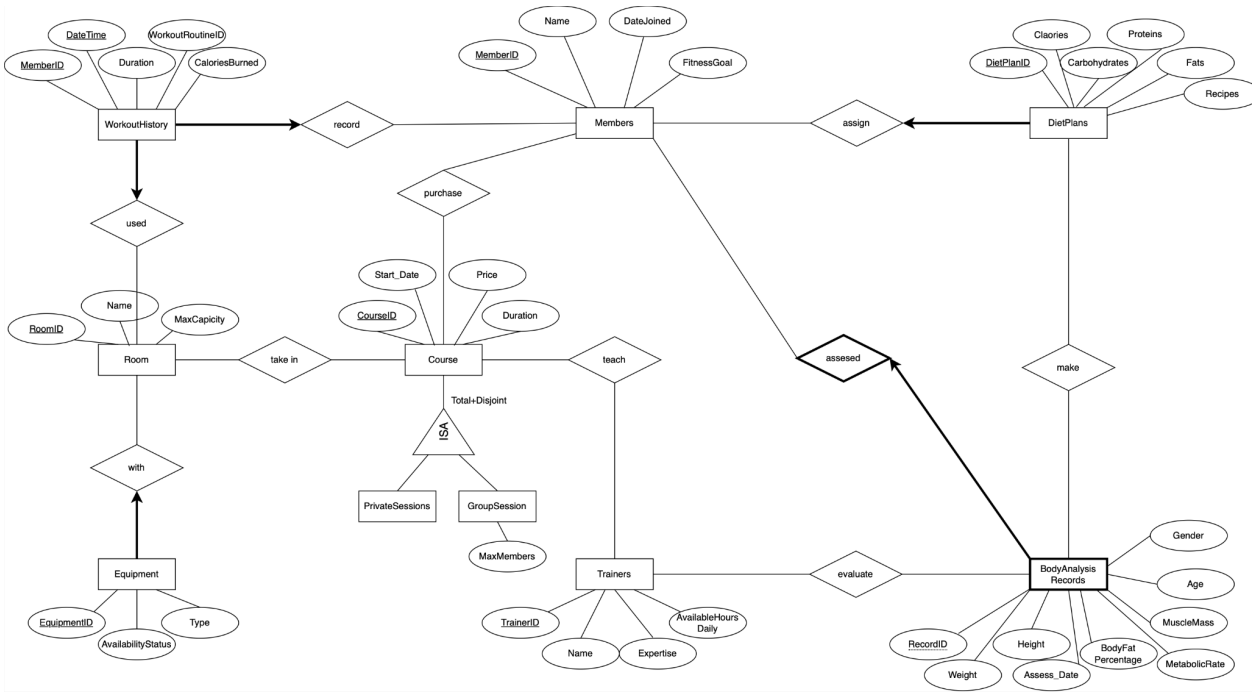

The schema derived from the ER diagram.

WorkoutHistory(HistoryID: integer, DateTime: TIMESTAMP, Duration: integer, CaloriesBurned: integer, ExerciseID: integer, **MemberID**: integer, **RoomID**: integer)

- PK: HistoryID
- CK: HistoryID
- FK: **MemberID** REFERENCES Member, **RoomID** REFERENCES Room
- Constraints: HistoryID, **MemberID**, **RoomID,** ExerciseID, DateTime are NOT NULL

Trainer(TrainerID: integer, Name: char[30], Expertise: char[30], AvailableHoursDaily: integer)

- PK: TrainerID
- CK: TrainerID
- Constraints: TrainerID, Name, AvailableHoursDaily are NOT NULL

Member(MemberID: integer, Name: char[30], DateJoined: DATE, FitnessGoal: char[30])

- PK: MemberID
- CK: MemberID
- Constraints: MemberID, Name, DateJoined are NOT NULL

assessed_BosyAnalysisRecord(RecordID: integer, Weight: float, Height: float, BodyFatPercentage: float, Assess_Date: DATE, MetabolicRate: float, MuscleMass: float, Age: integer, Gender: char[10], **MemberID**: integer)

- PK: RecordID, **MemberID**

- CK: RecordID, **MemberID**
- FK: **MemberID** REFERENCES Member
- Constraints: **MemberID** is NOT NULL

DietPlan(DietPlanID: integer, Calories: integer, Carbohydrates: integer, Proteins: integer, Fats: integer, Recipes: char[100], **MemberID**: integer)
- PK: DietPlanID
- CK: DietPlanID
- FK: **MemberID** REFERENCES Member
- Constraints: DietPlanID, Calories, Recipes, **MemberID** are NOT NULL

Course(CourseID: integer, Start_Date: DATE, Price: float, Duration: integer)
- PK: CourseID
- CK: CourseID
- Constraints: CourseID, Start_Date, Price, Duration are NOT NULL

PrivateSession(**CourseID:** integer)
- PK: **CourseID**
- CK: **CourseID**
- Constraints: **CourseID** is NOT NULL

GroupSession(MaxMembers: integer, **CourseID:** integer)
- PK: **CourseID**
- CK: **CourseID**
- Constraints: **CourseID** is NOT NULL

Room(RoomID: integer, Name: char[20], MaxCapacity: integer)
- PK: RoomID
- CK: RoomID
- Constraints: RoomID, MaxCapacity, Name

Equipment(EquipmentID: integer, AvailabilityStatus: char[10], Type: char[20], **RoomID**: integer)
- PK: EquipmentID,
- CK: EquipmentID
- FK: **RoomID** REFERENCES Room
- Constraints: EquipmentID, AvailabilityStatus, Type are NOT NULL

purchase(**MemberID**: integer, **CourseID**: integer)
- PK: **MemberID, CourseID**
- CK: **MemberID, CourseID**
- FK: **MemberID** REFERENCES Member, **CourseID** REFERENCES Course
- Constraints: **MemberID, CourseID** are NOT NULL

make(**RecordID**: integer, **MemberID**: integer, **DietPlanID**: integer)

- PK: **RecordID**, **MemberID**, **DietPlanID**
- CK:**RecordID**, **MemberID**, **DietPlanID**
- FK: **RecordID** RFERENCES BodyAnalysisRecord, **MemberID** REFERENCES assessed_BosyAnalysisRecord, **DietPlanID** REFERENCES DietPlan
- Constraints: **MemberID**, **DietPlanID** are NOT NULL

evaluate(**RecordID**: integer, **MemberID**: integer, **TrainerID**: integer)

- PK: **RecordID**, **MemberID**, **TrainerID**
- CK: **RecordID**, **MemberID**, **TrainerID**
- FK: **RecordID** RFERENCES BodyAnalysisRecord, **MemberID** REFERENCES assessed_BosyAnalysisRecord, **TrainerID** REFERENCES Trainer
- Constraints: **MemberID**, **TrainerID** are NOT NULL

teach(**TrainerID**: integer, **CourseID**: integer)

- PK: **CourseID**, **TrainerID**
- CK: **CourseID**, **TrainerID**
- FK: **TrainerID** REFERENCES Trainer, **CourseID** REFERENCES Course
- Constraints: **CourseID**, **TrainerID** are NOT NULL

take_in(**CourseID**: integer, **RoomID**: integer)

- PK: **CourseID**, **RoomID**
- CK: **CourseID**, **RoomID**
- FK: **TrainerID** REFERENCES Trainer, **RoomID** REFERENCES Room
- Constraints: **CourseID**, **RoomID** are NOT NULL

Functional Dependencies (FDs)

WorkoutHistory:
HistoryID -> DateTime, Duration, ExerciseID, CaloriesBurned, MemberID, RoomID
Duration, ExerciseID -> CaloriesBurned

Room:
RoomID -> Name, MaxCapacity

Equipment:
EquipmentID -> AvailabilityStatus, Type, RoomID

Course:
CourseID -> Start_Date, Price, Duration

PrivateSessions:
CourseID -> Start_Date, Price, Duration

GroupSession:
CourseID -> Start_Date, Price, Duration, MaxMembers

Member:
MemberID -> Name, DateJoined, FitnessGoal

Trainer:
TrainerID -> Name, Expertise, AvailableHours Daily

DietPlan:
DietPlanID -> Calories, Carbohydrates, Proteins, Fats, Recipes, MemberID
Carbohydrates, Proteins, Fats -> CaloriesMemberID-> DietPlanID, Calories, Carbohydrates, Proteins, Fats, Recipes, MemberID
Recipes -> Carbohydrates, Proteins, Fats, Calories

assessed_BodyAnalysisRecord:
MemberID, RecordID -> Weight, Height, Assess_Date, BodyFatPercentage, MetabolicRate, MuscleMass, Age, Gender
Weight, Height, Age -> MetabolicRate
Weight, Height, Age, Gender -> BodyFatPercentage

Normalization

We will check and normalize tables to be in BCNF.

$\{Duration, ExerciseID\}^+ = \{Duration, ExerciseID, CaloriesBurnt\}$

R_1 (HistoryID. Date & Time. Duration, ExerciseID, MemberID. RoomID)
R_2(Duration, ExerciseID. CaloriesBurnt)

WorkoutHistory1(HistoryID: integer, DateTime: TIMESTAMP, **Duration**: integer, **ExerciseID**: integer, **MemberID**: integer, **RoomID**: integer)

- PK: HistoryID
- CK: HistoryID
- FK:
  (ExerciseID, Duration) REFERENCES WorkoutHistory2(ExerciseID, Duration)

RoomID REFERENCES Room(RoomID)
MemberID REFERENCES Member(MemberID)

WorkoutHistory2(ExerciseID: integer, Duration: integer, CaloriesBurned: integer)
- PK: ExerciseID, Duration
- CK: ExerciseID, Duration

Room(RoomID: integer, Name: char[20], MaxCapacity: integer)
- PK: RoomID
- CK: RoomID

Equipment(EquipmentID: integer, AvailabilityStatus: char[10], Type: char[20], **RoomID**: integer)
- PK: EquipmentID
- CK: EquipmentID
- FK: **RoomID** REFERENCES Room(RoomID)

Course(CourseID: integer, Start_Date: DATE, Price: float, Duration: integer)
- PK: CourseID
- CK: CourseID

PrivateSession(**CourseID:** integer)
- PK: **CourseID**
- CK: **CourseID**
- FK: **CourseID** REFERENCES Course(CourseID)

GroupSession(**CourseID:** integer, MaxMembers: integer)
- PK: **CourseID**
- CK: **CourseID**
- FK: **CourseID** REFERENCES Course(CourseID)

Member(MemberID: integer, Name: char[30], DateJoined: DATE, FitnessGoal: char[30])
- PK: MemberID
- CK: MemberID

Trainer(TrainerID: integer, Name: char[30], Expertise: char[30], AvailableHoursDaily: integer)
- PK: TrainerID
- CK: TrainerID

{Carbohydrates, Proteins, Fats}$^+$ = {Carbohydrates, Proteins, Fats, Calories}

Recipes$^+$ = {Carbohydrates, Proteins, Fats, Calories, Recipes}

R_1 (Recipes, Carbohydrates, Proteins, Fats, Calories)

R_2 (Recipes, DietPlanID, MemberID)

R_3 (Carbohydrates, Proteins, Fats, Calories)

R_4 (Carbohydrates, Proteins, Fats, Recipes)

Final Answer:

R_2 (Recipes, DietPlanID, MemberID)

R_3 (Carbohydrates, Proteins, Fats, Calories)

R_4 (Carbohydrates, Proteins, Fats, Recipes)

(Abbreviations:
DPID: DietPlanID, MID: MemberID, CH: Carbohydrates, P: Proteins, F: Fats, C: Calories)

DietPlan2(DietPlanID: integer, Recipes: char[100], **MemberID**: integer)

- PK: DietPlanID
- CK: DietPlanID
- FK: **MemberID** REFERENCES Member(MemberID)

DietPlan3(Carbohydrates: integer, Proteins: integer, Fats: integer, Calories: integer)

- PK: Carbohydrates, Proteins, Fats
- CK: Carbohydrates, Proteins, Fats

DietPlan4(Recipes: char[100], **Carbohydrates**: integer, **Proteins**: integer, **Fats**: integer)

- PK: Recipes
- CK: Recipes
- FK: **(Carbohydrates, Proteins, Fats)** REFERENCES DietPlan3(Carbohydrates, Proteins, Fats)

{Weight, Height, Age}$^+$ = {Weight, Height, Age, MetabolicRate}

{Weight, Height, Age, Gender}$^+$

= {Weight, Height, Age, Gender, BodyFatPercentage, MetabolicRate}

R_1 (MetabolicRate, Weight, Height, Age)

R_2 (Weight, Height, Age, MemberID, RecordID, Date, BodyFatPercentage, MuscleMass, Gender)

R_3 (Weight, Height, Age, Gender, BodyFatPercentage)

R_4 (Weight, Height, Age, Gender, MemberID, RecordID, Date, MuscleMass)

Final Answer:

R_1 (MetabolicRate, Weight, Height, Age)

R_3 (Weight, Height, Age, Gender, BodyFatPercentage)

R_4 (Weight, Height, Age, Gender, MemberID, RecordID, Date, MuscleMass)

(Abbreviations:
MID: MemberID, RID: RecordID, BFP: BodyFatPercentage, MM: MuscleMass, WT: Weight, HT: Height, MR: MetabolicRate)

assessed_BodyAnalysisRecord1(Age: integer, Weight: float, Height: float, MetabolicRate: float)

- PK: Weight, Height, Age
- CK: Weight, Height, Age

assessed_BodyAnalysisRecord3(**Age**: integer, **Weight**: float, **Height**: float, Gender: char[10], BodyFatPercentage: float)

- PK: Weight, Height, Age, Gender
- CK: Weight, Height, Age, Gender
- FK:
  (Age, Weight, Height) REFERENCES assessed_BodyAnalysisRecord1(Weight, Height, Age)

assessed_BodyAnalysisRecord4(RecordID: integer, **Age**: integer, **Weight**: float, **Height**: float, **Gender**: char[10], Assess_Date: DATE, MuscleMass: float, MemberID: integer)

- PK: RecordID, MemberID
- CK: RecordID, MemberID
- FK:
  MemberID REFERENCES Member(MemberID)
  (Age, Weight, Height, Gender) REFERENCES assessed_BodyAnalysisRecord3(Age, Weight, Height, Gender)

purchase(**MemberID**: integer, **CourseID**: integer)

- PK: **MemberID, CourseID**
- CK: **MemberID, CourseID**
- FK: **MemberID** REFERENCES Member(MemberID), **CourseID** REFERENCES Course(CourseID)

make(**RecordID**: integer, **MemberID**: integer, **DietPlanID**: integer)

- PK: **RecordID**, **MemberID**, **DietPlanID**
- CK: **RecordID**, **MemberID**, **DietPlanID**
- FK: **RecordID, MemberID** RFERENCES BodyAnalysisRecord4(RecordID, MemberID), **DietPlanID** REFERENCES DietPlan2(DietPlanID)

evaluate(**RecordID**: integer, **MemberID**: integer, **TrainerID**: integer)

- PK: **RecordID**, **MemberID**, **TrainerID**
- CK: **RecordID**, **MemberID**, **TrainerID**
- FK: **RecordID, MemberID** RFERENCES BodyAnalysisRecord4(RecordID, MemberID), **TrainerID** REFERENCES Trainer(TrainerID)

teach(**TrainerID**: integer, **CourseID**: integer)

- PK: **CourseID**, **TrainerID**
- CK: **CourseID**, **TrainerID**

- FK: **TrainerID** REFERENCES Trainer(TrainerID), **CourseID** REFERENCES Course(CourseID)

take_in(**CourseID**: integer, **RoomID**: integer)

- PK: **CourseID**, **RoomID**
- CK: **CourseID**, **RoomID**
- FK: **TrainerID** REFERENCES Trainer(TrainerID), **RoomID** REFERENCES Room(RoomID)