

Part A – Topic Description

The Beckenham Walkers is a group of people who enjoy walking and aim to schedule three or more **walk events** for their **members** through green spaces in Kent.

For each **walk event**, the **route** that will be taken is pre-set, along with the **meeting point** where the **members** and the **instructor** gather. As the route is pre-set, the **members** can know vital pieces of information about it before attending, such as its difficulty – easy, moderate or strenuous – and length. Walks of varying difficulty are aimed to be scheduled regularly so every **member**, including beginners, can attend **walk events**.

During the **route**, there is an organised stop at a local **café**. Therefore, the location of a **café** along the **route** is determined during planning. Similarly, most **members** drive to the **meeting point** so ensuring a **carpark** is located close by is essential. **Members** are provided with the **car park's** location and cost to park prior to the **walk event**.

Currently, **members** just turn up for a **walk event** after seeing them advertised on the website. However, this means that some walks are very busy whilst others have few people attending. This uncertainty around numbers leads to the following issues:

- the **instructor** has no idea how many people are attending, or their experience level beforehand so cannot prepare.
- the **cafes** and **carparks** may not be large enough for all the **members** attending.

Furthermore, the group has around 100 **members** and 20 **instructors** so having their information stored in a database will be important for many tasks. For example, keeping track of numbers, ensuring enough **instructors** are employed, and monitoring **route** popularity.

Consequently, The Beckenham Walkers have identified the requirement of a system to hold information about:

- Every scheduled **walk event**
- the predetermined **routes** that can be taken
- the **meeting points** for the walk events
- the **cafes** and **carparks** associated with each walk event
- the **instructors** that conduct the walks
- the **members** of The Beckenham Walkers

Entities in the System

The following entities have been identified for inclusion within the system:

Entity #	Entity Name	Spatial	3D
1	Route	Yes	No
2	Café	Yes	Yes
3	Carpark	Yes	No
4	Member	No	No
5	Instructor	No	No
6	Walk Event	No	No
7	Meeting Point	Yes	No
Totals	7	4	1

Requirements of the System

The following table lists the requirements that the system will meet, as outlined by the topic description:

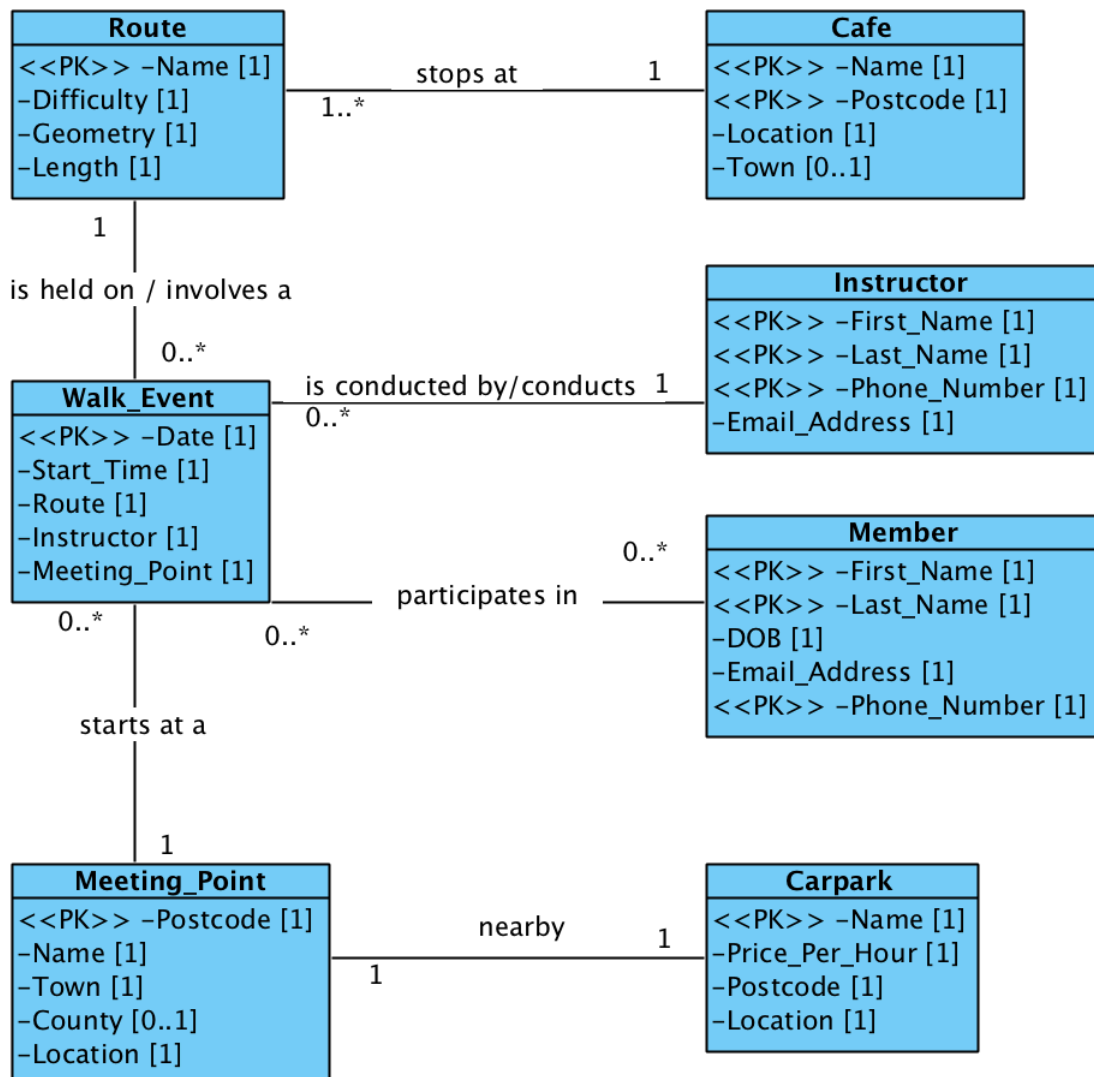
Requirement #	Requirement	Entity or Entities Required	Spatial Query	Join
1	What is the distance from the carpark to the meeting point?	Meeting point, Carpark	Yes	Yes
2	What is the length of each route?	Route	Yes	No
3	Which members are going on a given walk event?	Members, Walk event	No	Yes
4	Which instructor is in charge of a given walk event?	Instructor, Walk event	No	Yes
5	What is the area of each café?	Café	Yes	No
6	What is the area of each carpark?	Carpark	Yes	No
7	How many walk events are scheduled for each difficulty?	Walk Event, Route	No	Yes
8	How many walk events are being held in any given month?	Walk Event	No	No
9	Do any given routes intersect?	Walk Event	Yes	No
10	Which meeting points are located within a carpark?	Carpark, Meeting point	Yes	Yes
Totals	11	N/A	6	5

Part B – Conceptual Design

The following section presents a fully documented UML Entity-Relationship diagram for the database to be used with the system proposed for The Beckenham Walkers.

Section A firstly displays the E-R diagram, which gives the entities and their attributes, primary key identifiers, relationships between entities, and cardinality of these relationships. Section B then provides documentation for the diagram, thus providing descriptions for each component, business rules and integrity constraints, any derivations, and assumptions made.

Section A: The E-R Diagram



Section B: Documentation for the E-R Diagram

B.1: Descriptions for each entity

This section lists each entity, including a description of each, its relationship and cardinality to other entities, its attributes, and its identifiers.

Entity 1: Route

The route entity holds information regarding the pre-set path that will be taken by the instructor during each walk event. As this is a spatial entity, the geometry of the route is stored as coordinates, which form a line. Additionally, attributes such as the route difficulty – easy, moderate or strenuous – and its length are stored. The unique identifier for the route entity is the name it is given. This may be, for example, “Walk through High Elms”. Each attribute within this entity is mandatory.

The route entity has relationships with the café entity and the walk event entity. The former as each route must stop at one, and only one, café as outlined in the topic description. However, there may be many routes that stop at one given café. The latter as there can be many walk events that include one given route, however, there may also be no walk events currently scheduled that include a given route.

Entity 2: Café

The café entity is the only 3D entity within the system. This spatial information is held within the location attribute as x, y and z coordinates. The unique identifier is made up of both the name and postcode attributes. Both of these attributes are included as there may be many coffee shops named “Costa” within the system, however, it is assumed that two cafes of the same name will not fall within one postcode. The town attribute is optional and can be entered to give more information.

The café entity has a relationship with the route entity only, as each café must be located along one or more routes.

Entity 3: Walk Event

The walk event entity holds information regarding the date, start time, route, instructor, and meeting point of each scheduled walk. Each of these attributes is, therefore, mandatory. The

date attribute is the identifier for this entity, as a business rule was outlined stating that only one walk event is held on any given date.

The walk event entity has a relationship with four entities:

- Route – every walk event must have one, and only one, predetermined route.
- Instructor – every walk event must have one, and only one, assigned instructor.
- Member – every walk may have many members booked on to it. Equally, there may be no members booked on.
- Meeting point – every walk event must include one, and only one, meeting point.

Entity 4: Member

The member entity contains information about each member of The Beckenham Walkers, including their first and last name, date of birth, email address, and phone number. Each attribute is mandatory. The unique identifier is made up of three attributes: first name, last name and phone number. This is due to the assumption that two members may have the same full name, but not the same phone number as well. Date of birth is a required attribute due to an integrity rule outlined for the system that each member must be over the age of 18 to register.

This entity has a many-to-many relationship with the walk event entity¹, as one member may be booked onto many walk events, whilst each walk event may have many members booked onto it.

Entity 5: Meeting Point

This entity represents the point where the instructor and the members attending the walk event will meet before being guided to the route. It includes the attributes postcode, which is the unique identifier, name, town, county and location. Each attribute is mandatory, except for the county attribute, which is optional. The spatial information will be held in the location attribute as a coordinate pair.

This entity has a relationship with the walk event and carpark entities. This is because there will be one, and only one, meeting point associated with each walk event, and one, and only one, meeting point located nearby each carpark.

¹ The many-to-many relationship between the Member and Walk Event entities will be resolved with the creation of a 'Walk Attendees' link table in the logical diagram.

Entity 6: Instructor

The instructor entity contains information about each instructor employed by The Beckenham Walkers, including their first and last name, phone number, and email address, where each attribute is mandatory. The unique identifier is made up of three attributes: first name, last name and phone number. It is therefore assumed that two instructors will not have the same first name, last name and phone number.

This entity has a relationship with the walk event entity as there must be one, and only one, instructor per walk event. However, each instructor may be associated with many walk events.

Entity 7: Carpark

The carpark entity represents the area where members will park their cars before the walk event. It will be stored as a rectangle 2D polygon represented by coordinates. It has the attributes name, price per hour, postcode and location, all of which are mandatory. The unique identifier is the name attribute, as it is assumed that no two car parks will have the same name.

This entity has a relationship with the meeting point entity as there will be one, and only one, carpark located nearby each meeting point.

B.2: Business rules and integrity constraints

The following business rules have been outlined from the description given:

- Each walk event must have one, and only one, instructor assigned to it.
- Every walking route must stop at one, and only one, café.
- There must be one, and only one, carpark assigned to each meeting point.
- Only one walk event can be held on any given date.
- Each meeting point should be as close to the carpark as possible or may fall within the car park.

The following integrity constraints are associated with the diagram:

- Each member must be over 18 to register with The Beckenham Walkers.
- For each entity there is an identifier to ensure each record is unique.
- Route Name provides the unique identifier for the Route entity.
- Café Name and Postcode provide the unique identifier for the Café entity.
- Walk Event Date provides the unique identifier for the Walk Event entity.

- Member First Name, Last Name and Phone Number provide the unique identifier for the Member entity.
- Meeting Point Post Code provides the unique identifier for the Meeting Point entity.
- Instructor First Name, Last Name and Phone Number provide the unique identifier for the Instructor entity.
- Carpark Name provides the unique identifier for the Carpark entity.

B.3: Derivations and information calculated from stored data

The following pieces of information can be derived from the stored data:

- The age of each member can be calculated from their date of birth.
- The area of each café can be derived from the 2D (x,y) coordinates.
- The volume of each café can be derived from the 3D (x,y,z) coordinates.
- The area of each carpark can be derived from the 2D (x,y) coordinates.
- The number of members can be generated by totalling the records entered in the member entity.
- The number of instructors can be generated by totalling the records entered in the instructor entity.
- The ratio of instructors to members can be generated by comparing the total number of instructors with the total number of members.

Additionally, the length attribute within the route entity will be calculated from the geometry of the line representing the route.

B.4: Any assumptions made

The following assumptions have been made:

- All cafes will be modelled in 3D with a flat roof.
- Each route is predetermined before the walk event, therefore can be modelled in 2D as a line.
- Each route starts and ends at the same point.
- All carparks are modelled in 2D as a polygon. Their shape will be simplified in all cases as a rectangle.
- Each meeting point will be modelled as a point, represented as a single coordinate pair.

- There will be one, and only one, café along each route as this is an organised stop.
- No two car parks will have the same name. This name is either given by the carpark, or is a colloquial name given by the group. For example: 'High Elms Car Park'.
- The meeting point name may be a colloquial name or given relating to local features. For example, a meeting point may be named 'War Memorial'.
- The meeting point may not be at the start of the route line. It may be next to or within the carpark, for example, and then instructor will guide the members to the route.
- Each walk event is conducted by one, and only one, instructor.
- No two cafes with the same name will be located within the same postcode.
- There is only one meeting point within a single postcode.
- There will not be any members that share the same first name, last name and phone number.
- There will not be any instructors that share the same first name, last name and phone number.