Code

```
SimAnt <- function(nSimulations, MaxMoves, Question){

  PossibleMoves <- c("Up","Down", "Left", "Right")
  TotalMoves <- 0
  Diverge <- FALSE

  for (i in 1:nSimulations){
    Coords <- c(0,0)
    names(Coords) <- c("x","y")
    NumberMoves <- 0

    while (!FoundFood(Coords, Question) & NumberMoves < MaxMoves){
      Move <- sample(PossibleMoves, 1, prob = c(rep(1/4,4)))
      NumberMoves = NumberMoves + 1

      if (Move == "Up") Coords["y"] = Coords["y"] + 10
      if (Move == "Down") Coords["y"] = Coords["y"] - 10
      if (Move == "Left") Coords["x"] = Coords["x"] - 10
      if (Move == "Right") Coords["x"] = Coords["x"] + 10

      if (NumberMoves == MaxMoves){
        Diverge <- TRUE
        print(paste("Reached", MaxMoves,
                    "moves, box is likely not bounded and avg moves diverges", sep=" "))
        break
      }
    }
    if (Diverge){
      print("Stopping...")
      break
    }
    TotalMoves <- TotalMoves + NumberMoves
  }

  if (!Diverge){
    print(paste("Took",TotalMoves/nSimulations,"on average", sep=" "))
  }
}

FoundFood <- function(Coords, Question){

  if (Question == 1){
    if(Coords["x"] != 20 &
       Coords["y"] != 20 &
       Coords["x"] != -20 &
       Coords["y"] != -20){
      return(FALSE)} else return(TRUE)
  }

  if (Question == 2){
    if (Coords["x"] + Coords["y"] < 10) return(FALSE) else return(TRUE)
```

```
  }

  if (Question == 3){
    if ((((Coords["x"]-2.5)/30)*2 + ((Coords["y"]-2.5)/40)*2) < 1) {
      return(FALSE)} else return(TRUE)
  }
}
```

Question 1

```
SimAnt(nSimulations = 10000, MaxMoves = 10000, Question = 1)
```

```
## [1] "Took 4.5247 on average"
```

Converges to **4.5** as $n \to \infty$

Question 2

```
SimAnt(nSimulations = 10000, MaxMoves = 10000, Question = 2)
```

```
## [1] "Reached 10000 moves, box is likely not bounded and avg moves diverges"
## [1] "Stopping..."
```

Diverges as the area is not bounded

Question 3

```
SimAnt(nSimulations = 10000, MaxMoves = 10000, Question = 3)
```

```
## [1] "Reached 10000 moves, box is likely not bounded and avg moves diverges"
## [1] "Stopping..."
```

Diverges as the area is not bounded