BIOS668 HW7
Sara O'Brien

Honor Code: On my honor, I have neither given no received unauthorized aid on this assignment. *Sara O'Brien*

Q1.
6, 6, 6, 6 + , 7, 9 + , 10, 10+ , 11+ , 13, 16, 17+ 19+ , 20+ , 22, 23, 25+ , 32+ , 32+ , 34+ , 35+

Time	# at risk (r)	# censored (c)	# death (d)	1 – d/r	Survival Probability
6	21	1	3	0.857	0.857
7	17	0	1	0.941	0.857*((17-1)/17) = 0.807
9	16	1	0	1	0.807*((16-0)/16) = 0.807
10	15	1	1	0.933	0.807*((15-1)/15) = 0.753
11	13	1	0	1	0.753*((13-0)/13) = 0.753
13	12	0	1	0.917	0.753*((12-1)/12) = 0.690
16	11	0	1	0.909	0.690*((11-1)/11) = 0.627
17	10	1	0	1	0.627*((10-0)/10) = 0.627
19	9	1	0	1	0.627*((9-0)/9) = 0.627
20	8	1	0	1	0.627*((8-0)/8) = 0.627
22	7	0	1	0.857	0.627*((7-1)/7) = 0.538
23	6	0	1	0.833	0.538*((6-1)/6) = 0.448
25	5	1	0	1	0.448*((5-0)/5) = 0.448
32	4	2	0	1	0.448*((4-0)/4) = 0.448
34	2	1	0	1	0.448*((2-0)/2) = 0.448
35	1	1	0	1	0.448*((1-0)/1) = 0.448

Q2.

Table (time=1)	Treatment A	Placebo	Total
Number of Deaths	0	2	2
Number Alive	21	19	40
Number at Risk	21	21	42

Table (time=2)	Treatment A	Placebo	Total
Number of Deaths	0	2	2
Number Alive	21	17	38
Number at Risk	21	19	40

Table (time)	O	E	Var(O)
1 (time=1)	0	1	0.488
2 (time=2)	0	1.05	0.486

Q3. We can validate the sample size calculation, 1832, from the Whelan et al. paper using a 5-year survival rate of 75% as follows with formula, SAS PROC power, and simulation:

$$d = \frac{(z_{1-\alpha/2} + z_{1-\beta})^2 / p(1-p)}{(\log(HR))^2}$$

$$= \frac{(1.96 + 0.842)^2}{(\log(0.73))^2 (0.75 \cdot 0.25)}$$

$$= 2241.52$$

SAS Code:

```
*************************************************************************
*  Assignment:    BIOS668 HW7
*  Name:          Sara O'Brien
*  Date:          4/9/23
*************************************************************************;

proc power;
   twosamplesurvival test=logrank
      curve("Standard") = (5):(0.75)
      refsurvival = "Standard"
      hazardratio = 0.73
      accrualtime = 4
      followuptime = 3
      ntotal = .
      power = 0.8;
run;

data sim_data;
  call streaminit(730317945);
  do n_sim = 1 to 10;
      do i = 1 to floor(1832/2);
        y = rand('exponential', 1/0.75);
        c = rand('uniform', 0,3);
        t = min(y,c);
        if y <= c then e = 1;
        else if y >= c then e = 0;
        output;
      end;
  end;
run;

proc lifetest data=sim_data method=KM;
    by n_sim;
    time t*e(0);
run;
```

SAS Output:

The POWER Procedure
Log-Rank Test for Two Survival Curves

Fixed Scenario Elements	
Method	Lakatos normal approximation
Accrual Time	4
Follow-up Time	3
Reference Survival Curve	Standard
Form of Survival Curve 1	Exponential
Form of Survival Curve 2	Exponential
Hazard Ratio	0.73
Nominal Power	0.8
Number of Sides	2
Number of Time Sub-Intervals	12
Group 1 Loss Exponential Hazard	0
Group 2 Loss Exponential Hazard	0
Alpha	0.05
Group 1 Weight	1
Group 2 Weight	1

Computed N Total	
Actual Power	**N Total**
0.800	1444

The sample sizes produced are not exactly the same in part because certain simplifying assumptions and rounding result in differences between approaches, but in general these formula, software, and simulation approaches align with what we expect from the paper's stated sample size calculation.