P8130_HW2_wl2829

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Problem 1

Problem 1 (a)(b)

```
## problem 1 (a)
dbinom(24, size = 40, prob = 0.65)
```

```
## [1] 0.1031167
```

```
## problem 1 (b)
pbinom(23, size = 40, prob = 0.65, lower.tail = FALSE)
```

```
## [1] 0.7977604
```

problem 1 (c)

p = 0.65, q = 1 - 0.65 = 0.35, np > 5 and nq > 5, so we can use normal approximation to calcualte the probabilities. By using the continuity correction factor, we can use P(n-0.5<X<n+0.5) to replace P(X=n), P(X>n-0.5) to replace P(X>=n).

```
### problem 1 (a)
pbinom(23.5, size = 40, prob = 0.65, lower.tail = FALSE)-pbinom(24.5, size = 40, prob = 0.65, lower.tai
```

```
## [1] 0.1031167
```

```
### problem 1 (b)
pbinom(23.5, size = 40, prob = 0.65, lower.tail = FALSE)
```

```
## [1] 0.7977604
```

The approximation answer is equal to the original probabilities.

Problem 1 (d)

The expectation E is equal to

```
Expectation = np = 40 * 0.65
Expectation
```

```
## [1] 26
```

Problem 1 (e)

```
sigma_sq = sqrt(40 * 0.65 * 0.35)
sigma_sq
```

```
## [1] 3.016621
```

The SD is 3.0166206.

Problem 2

Problem 2 (a)

```
Lessthan3 = ppois(2, 7, lower.tail = TRUE) # the probability of having fewer than 3 tornados
Lessthan3
```

```
## [1] 0.02963616
```

Problem 2 (b)

```
equalto3 = dpois(3, 7, log = FALSE) # the probability of having exactly 3 tornados
equalto3
```

```
## [1] 0.05212925
```

Problem 2 (c)

```
morethan3 = ppois(3, 7, lower.tail = FALSE) # the probability of having more than 3 tornados
morethan3
```

```
## [1] 0.9182346
```

Problem 3

Problem 3 (a)

```
above137 = pnorm(137, mean = 132, sd = 9.8, lower.tail = FALSE)
above137
```

```
## [1] 0.3049542
```

Problem 3 (b)

```
lessthan129 = pnorm(129, mean = 132, sd = 9.8, lower.tail = TRUE)
lessthan129
```

```
## [1] 0.3797557
```

Problem 3 (c)

```
sample = rnorm(40, 132, 9.8)
quantile(sample, 0.9)
```

```
##      90%
## 145.2244
```

Problem 4

Problem 4 (a)

```
## sample mean = 75, sd = 8, sample size = 30
error = qnorm(0.975) * 8 / sqrt(30)
lower = 75 - error
upper = 75 + error
c(lower, upper)
```

```
## [1] 72.13729 77.86271
```

Problem 4 (b)

We are 95% confident that the population parameter is between 72.1372894 and 77.8627106.

Problem 4 (c)

Yes, we don't need to do extra calculation to reject H0, because the 95% confidence interval is between 72.1372894 and 77.8627106, which does not contain "70". Therefore, the null hypothesis μ = μ0 is rejected.