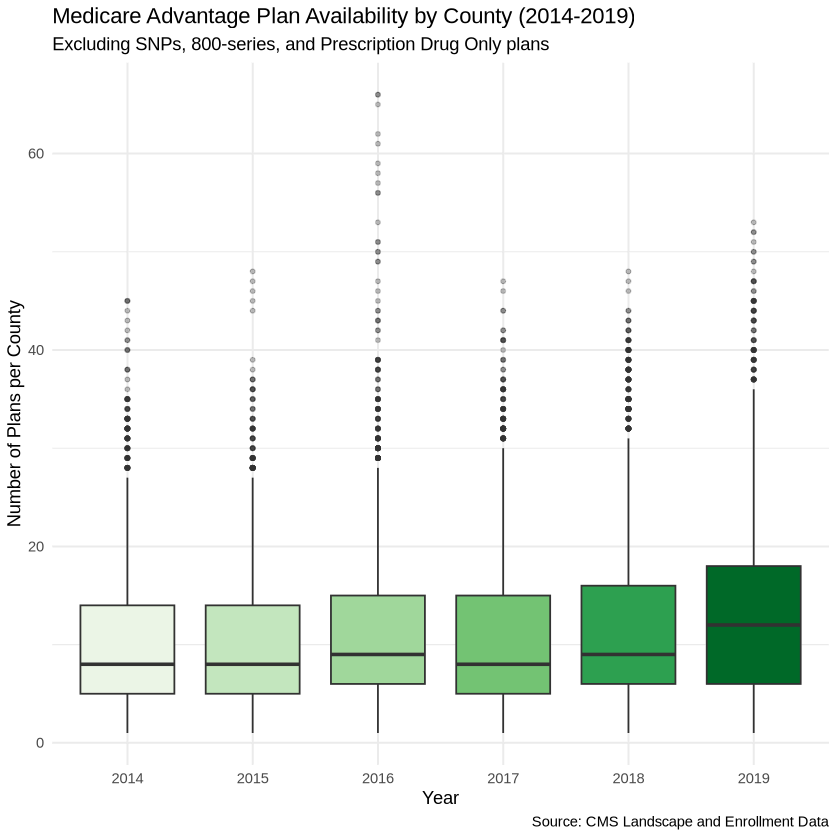
In [1]:
```r
if (!require("pacman")) install.packages("pacman")
pacman::p_load(tidyverse, ggplot2)

# Load master dataset
ma_final <- read_csv("../../hwk2/data/output/final_ma_data.csv")
```

```
Loading required package: pacman

Rows: 449046 Columns: 68
── Column specification ────────────────────────────────────────────────────────
Delimiter: ","
chr (18): contractid, state, county, org_type, plan_type, partd, snp, eghp,
...
dbl (50): source_year, planid, fips, year, n_nonmiss, avg_enrollment, n_eli
g...

ℹ Use `spec()` to retrieve the full column specification for this data.
ℹ Specify the column types or set `show_col_types = FALSE` to quiet this mes
sage.
```

Question 1

In [2]:
```r
# Filter
ma_summary <- ma_final %>%
  filter(
    snp == "No",                                    # Remove SNPs
    (as.numeric(planid) < 800 | as.numeric(planid) >= 900), # Remove 800-ser
    !is.na(premium)                                 # Part C only (removes PD
  )
# Calculate counts per county/year
county_counts <- ma_summary %>%
  group_by(fips, year) %>%
  summarize(plan_count = n(), .groups = "drop")

# Make Whisker Plot
ggplot(county_counts, aes(x = as.factor(year), y = plan_count, fill = as.fac
  geom_boxplot(outlier.size = 1, outlier.alpha = 0.3) +
  scale_fill_brewer(palette = "Greens") +
  labs(
    title = "Medicare Advantage Plan Availability by County (2014–2019)",
    subtitle = "Excluding SNPs, 800-series, and Prescription Drug Only plans
    x = "Year",
    y = "Number of Plans per County",
    caption = "Source: CMS Landscape and Enrollment Data"
  ) +
  theme_minimal() +
  theme(legend.position = "none")
```



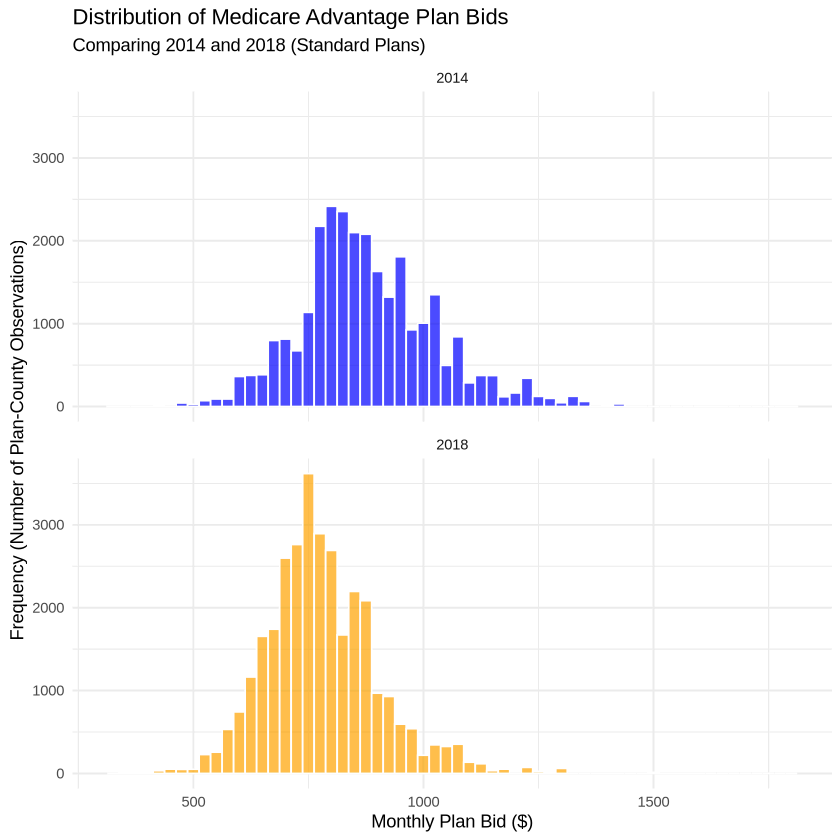
Question 2

In [3]:
```
# Prepare data for 2014 and 2018
bid_comparison <- ma_summary %>%
  filter(
    year %in% c(2014, 2018),
    snp == "No",                                    # Standard plans only
    (as.numeric(planid) < 800 | as.numeric(planid) >= 900), # Remove 800-ser
    !is.na(premium)                                 # Part C benefits present
  ) %>%
  filter(!is.na(bid), bid > 0, bid < 2000) # Remove NAs and extreme outliers

# Create histograms
ggplot(bid_comparison, aes(x = bid, fill = as.factor(year))) +
  geom_histogram(binwidth = 25, alpha = 0.7, color = "white", position = "id
  facet_wrap(~year, ncol = 1) +
  scale_fill_manual(values = c("2014" = "blue", "2018" = "orange")) +
  labs(
    title = "Distribution of Medicare Advantage Plan Bids",
    subtitle = "Comparing 2014 and 2018 (Standard Plans)",
    x = "Monthly Plan Bid ($)",
    y = "Frequency (Number of Plan-County Observations)",
  ) +
  theme_minimal() +
  theme(legend.position = "none")

# Calculate Summary stats
bid_comparison %>%
```

```
  group_by(year) %>%
  summarize(
    Mean_Bid = mean(bid, na.rm = TRUE),
    Median_Bid = median(bid, na.rm = TRUE),
    SD_Bid = sd(bid, na.rm = TRUE),
    Total_Obs = n()
  )
```

A tibble: 2 × 5

year	Mean_Bid	Median_Bid	SD_Bid	Total_Obs
<dbl>	<dbl>	<dbl>	<dbl>	<int>
2014	879.2834	861.6301	147.1013	27574
2018	779.7197	767.1708	122.5830	31855

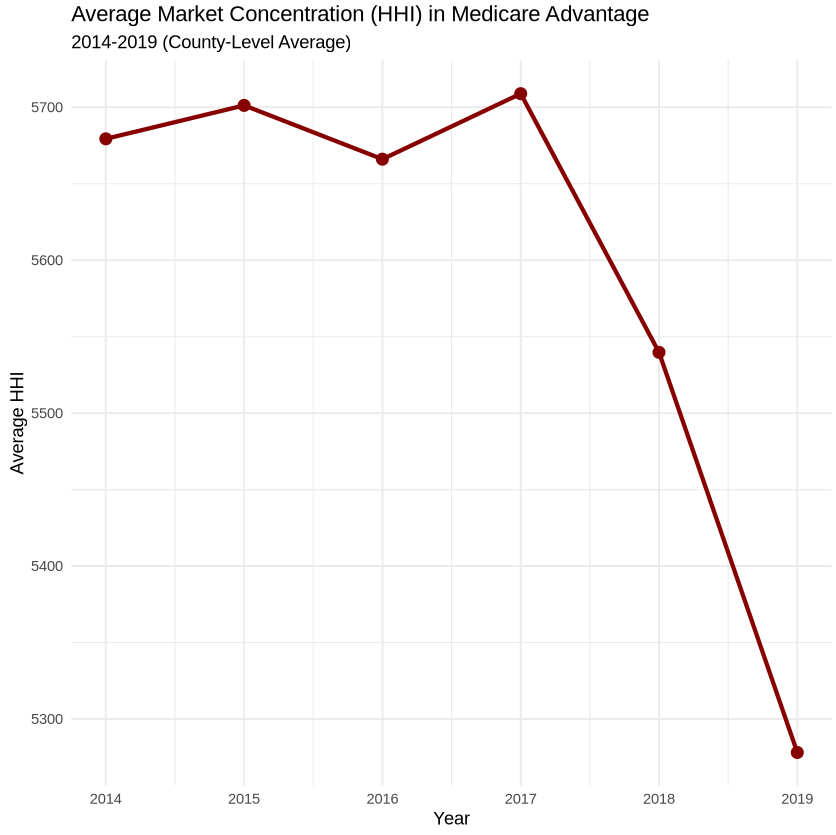


Question 3

In [4]:
```
# Prepare Enrollment Data
# Use 'parent_org' because many contracts (contractid) belong to the same co
county_shares <- ma_summary %>% # Use filtered data
  group_by(fips, year, parent_org) %>%
  summarize(org_enrollment = sum(avg_enrollment, na.rm = TRUE), .groups = "c
  mutate(
    total_county_enrollment = sum(org_enrollment, na.rm = TRUE),
    share = (org_enrollment / total_county_enrollment) * 100
  ) %>%
  filter(total_county_enrollment > 0) %>% # Avoid division by zero
```

```
  ungroup()

# Calculate HHI per County per Year
county_hhi <- county_shares %>%
  group_by(fips, year) %>%
  summarize(hhi = sum(share^2), .groups = "drop")

# Calculate National Average HHI over time
avg_hhi_trend <- county_hhi %>%
  group_by(year) %>%
  summarize(mean_hhi = mean(hhi, na.rm = TRUE))

# Plot
ggplot(avg_hhi_trend, aes(x = year, y = mean_hhi)) +
  geom_line(color = "darkred", size = 1.2) +
  geom_point(color = "darkred", size = 3) +
  scale_x_continuous(breaks = 2014:2019) +
  labs(
    title = "Average Market Concentration (HHI) in Medicare Advantage",
    subtitle = "2014-2019 (County-Level Average)",
    x = "Year",
    y = "Average HHI"
  ) +
  theme_minimal()
```

```
Warning message:
“Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.
ℹ Please use `linewidth` instead.”
```



In [5]:
```
# Checking names of top companies in 2018/2019
ma_summary %>%
```

```
  filter(year %in% c(2018, 2019)) %>%
  group_by(year, parent_org) %>%
  summarize(total = sum(avg_enrollment, na.rm = TRUE), .groups = "drop") %>%
  arrange(desc(total)) %>%
  head(10)
```

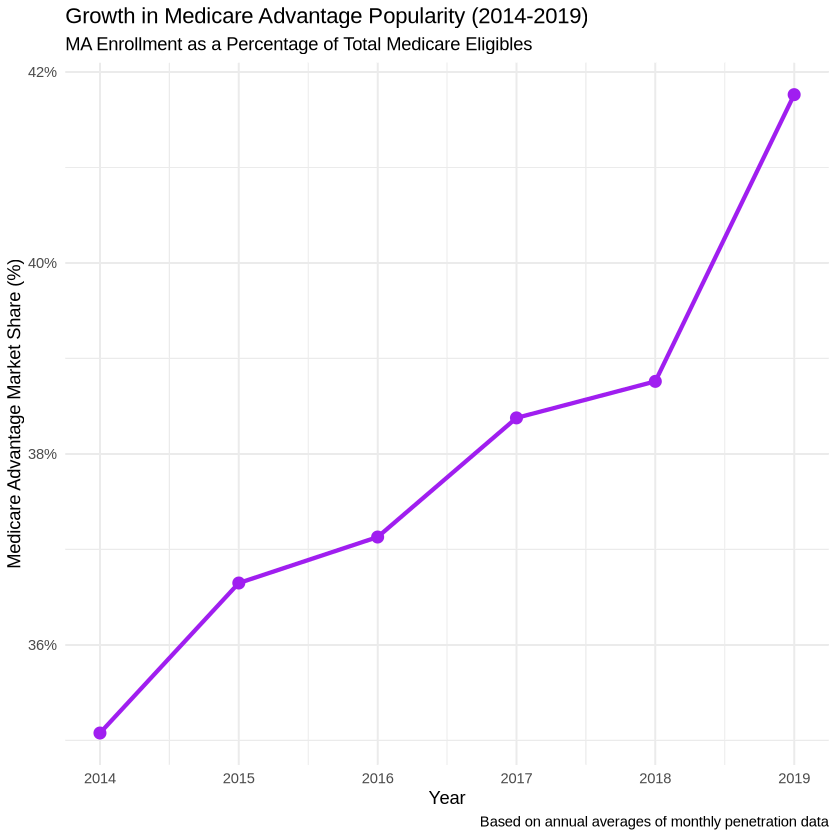
A tibble: 10 × 3

year	parent_org	total
<dbl>	<chr>	<dbl>
2019	UnitedHealth Group, Inc.	3291291.4
2019	Humana Inc.	3147325.5
2018	UnitedHealth Group, Inc.	3062790.4
2018	Humana Inc.	2746107.5
2019	CVS Health Corporation	1284283.2
2018	Aetna Inc.	983421.7
2019	Kaiser Foundation Health Plan, Inc.	923424.0
2018	Kaiser Foundation Health Plan, Inc.	886226.3
2019	Anthem Inc.	667606.5
2018	Anthem Inc.	599395.5

Question 4

In [6]:
```
# Prepare  popularity data
popularity_trend <- ma_summary %>%

group_by(year) %>%
summarize(
# We sum the averages across all counties to get the national total
national_enrolled = sum(avg_enrolled, na.rm = TRUE),
national_eligible = sum(avg_eligibles, na.rm = TRUE)
) %>%
# Calculate percentage
mutate(ma_share = (national_enrolled / national_eligible) * 100)

# Plot
ggplot(popularity_trend, aes(x = year, y = ma_share)) +
  geom_line(color = "purple", linewidth = 1.2) +
  geom_point(color = "purple", size = 3) +
  scale_x_continuous(breaks = 2014:2019) +
  scale_y_continuous(labels = scales::percent_format(scale = 1)) +
  labs(
    title = "Growth in Medicare Advantage Popularity (2014–2019)",
    subtitle = "MA Enrollment as a Percentage of Total Medicare Eligibles",
    x = "Year",
    y = "Medicare Advantage Market Share (%)",
```

```
    caption = "Based on annual averages of monthly penetration data"
  ) +
  theme_minimal()
```



Question 5

In [16]:
```
# Prepare 2018 Data for 5-10
# Using ma_summary ensures we only have general MA plans (no SNPs/800-series
ma_2018 <- ma_summary %>%
  filter(year == 2018) %>%
  group_by(fips) %>%
  mutate(
    total_county_enroll = sum(avg_enrollment, na.rm = TRUE),
    plan_share = if_else(total_county_enroll > 0, avg_enrollment / total_cou
    county_hhi = sum((plan_share * 100)^2, na.rm = TRUE)
  ) %>%
  ungroup()

# Thresholds
hhi_dist <- ma_2018 %>% distinct(fips, county_hhi)
hhi_thresholds <- quantile(hhi_dist$county_hhi, probs = c(0.33, 0.66), na.rm

ma_2018 <- ma_2018 %>%
  mutate(market_type = case_when(
    county_hhi <= hhi_thresholds[1] ~ "Competitive",
    county_hhi >= hhi_thresholds[2] ~ "Uncompetitive"
  )) %>%
```

```
  # Keep only the observations in our treatment/control groups
  filter(!is.na(market_type))
```

In [17]:
```
q5_results <- ma_2018 %>%
  group_by(market_type) %>%
  summarize(avg_bid = mean(bid, na.rm = TRUE))

print(q5_results)
```

```
# A tibble: 2 × 2
  market_type   avg_bid
  <chr>           <dbl>
1 Competitive      782.
2 Uncompetitive    787.
```

Question 6

In [21]:
```
ma_2018_quartiles <- ma_2018 %>%
  # Remove rows where cost data is missing so quartiles are accurate
  filter(!is.na(avg_ffscost)) %>%

  # Define quartiles
  mutate(ffs_quartile = ntile(avg_ffscost, 4)) %>%

  # Create the 4 binary indicator variables
  mutate(
    q1_ind = if_else(ffs_quartile == 1, 1, 0),
    q2_ind = if_else(ffs_quartile == 2, 1, 0),
    q3_ind = if_else(ffs_quartile == 3, 1, 0),
    q4_ind = if_else(ffs_quartile == 4, 1, 0)
  )

# 2. Summarize and Reshape
q6_summary <- ma_2018_quartiles %>%
  group_by(ffs_quartile, market_type) %>%
  summarize(avg_bid = mean(bid, na.rm = TRUE), .groups = "drop") %>%
  pivot_wider(names_from = market_type, values_from = avg_bid) %>%
  rename(Quartile = ffs_quartile)
```

In [28]:
```
q6_table <- q6_summary %>%
  rename(`FFS Cost Quartile` = Quartile) %>%
  mutate(
    Competitive = paste0("$", format(round(Competitive, 2), nsmall = 2)),
    Uncompetitive = paste0("$", format(round(Uncompetitive, 2), nsmall = 2))
  )

as.data.frame(q6_table)
```

A data.frame: 4 × 3

FFS Cost Quartile	Competitive	Uncompetitive
<int>	<chr>	<chr>
1	$792.57	$810.79
2	$788.77	$785.95
3	$773.82	$772.39
4	$771.03	$784.54

Question 7

In [ ]: