

# **C/C++ and Java Programmer Competitive Position™ Market Report**

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Whole Root™ Economic Research, Inc  
P.O. Box 603  
South Glastonbury, CT 06073

**<http://www.wholeroot.com/>**

Toll Free: 1-888-413-1792  
Fax: (860) 659-1792  
E-mail: [reports@wholeroot.com](mailto:reports@wholeroot.com)

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# Welcome

I established Whole Root™ Economic Research, Inc. in 1996 to provide extensive market analysis to individual decision makers. My Competitive Position™ Market Reports enable individuals to assess salary opportunities and set employment goals. It is the first affordable market analysis designed specifically to assist all participants in the job marketplace. Whether you are a computer professional, data processing manager or human resource professional, I hope you find this material useful.

Thank you,

Robert Gerald Vivona  
Economic Statistician

Toll Free: 1-888-413-1792

Fax: (860) 659-1792

E-mail: [bob@wholeroot.com](mailto:bob@wholeroot.com)

A Special Thanks to:

Nicholas Vivona  
Computer Industry Consultant

# C/C++ & Java Programmer Characteristics of Sample Data

Sample Source: The **New York Times** Sunday Employment section  
Dates: the 52 weeks (1 Year) from January 5 through December 28, 1997

Number of Classified Want Ads: 70

## Qualifications listed in the Want Ads

|                | To be Included Each<br>Want Ad Must Have  | Salary <b>Effectd</b><br>When Listed            | Salary <b>Not Effectd</b><br>when Listed  |
|----------------|---|---|---|
| Responsibility | Programmer, Programmer/Analyst,<br>Analyst, Systems Analyst, Software<br>Engineer or Designer/Developer |   |   |
| Hardware / OS  |   | UNIX &<br>WindowsNT = 22<br><br>UNIX alone = 23 |   |
| Language       | C, C++ or Visual C++<br>&<br>Java   |   | C++ & Java = 34<br>HTML = 20  |
| Database       |   |   | Oracle, Sybase,<br>SQL Server or Informix = 37  |
| Network        |   |   |   |
| MIS Software   |   |   |   |
| Industry       |   |   | Banking, Investment Banking,<br>Financial, Wall Street,<br>Insurance or Accounting = 31 |

## Job Description

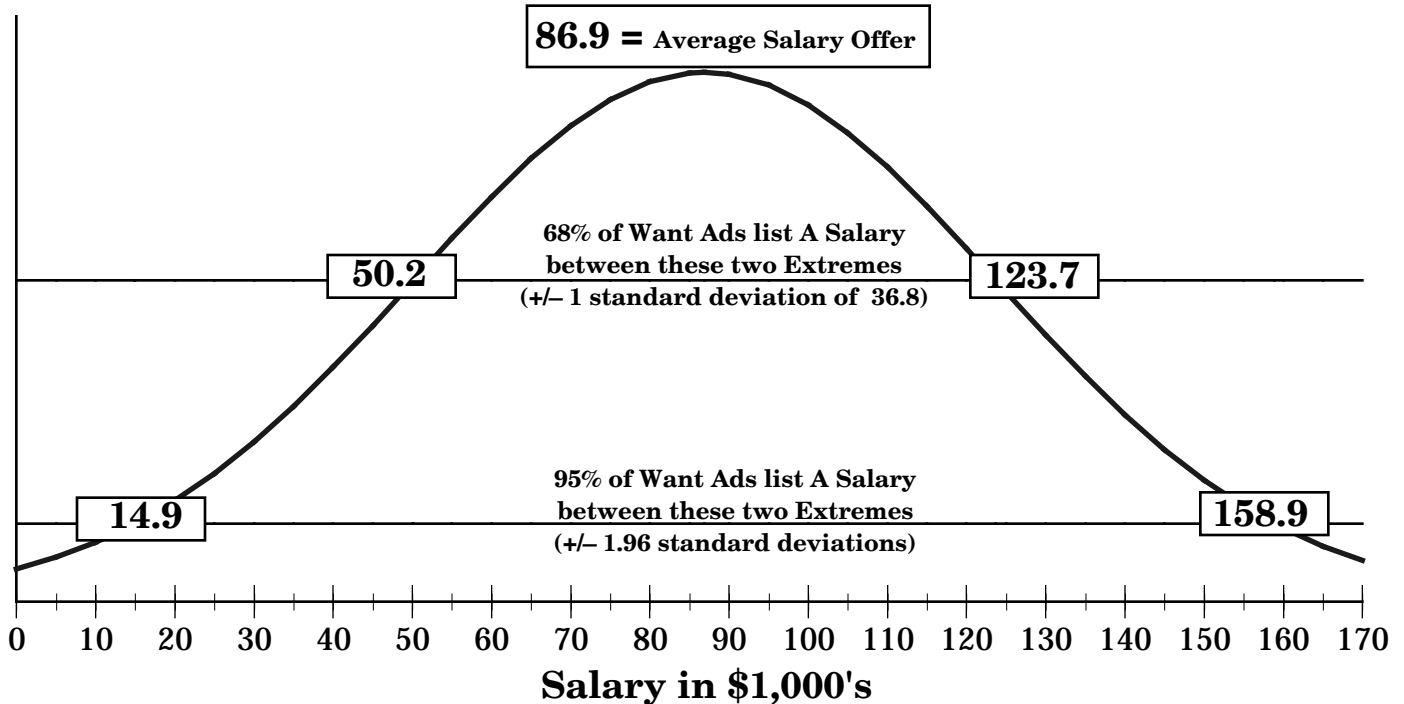
- Translates user requirements into design specifications for a new application, or, to reengineer and enhance existing applications
- Codes application modules based on a design document
- Integrates, Tests, Debugs and Implements application modules and documents the results

# C/C++ & Java Programmer Sample Averages and Distributions

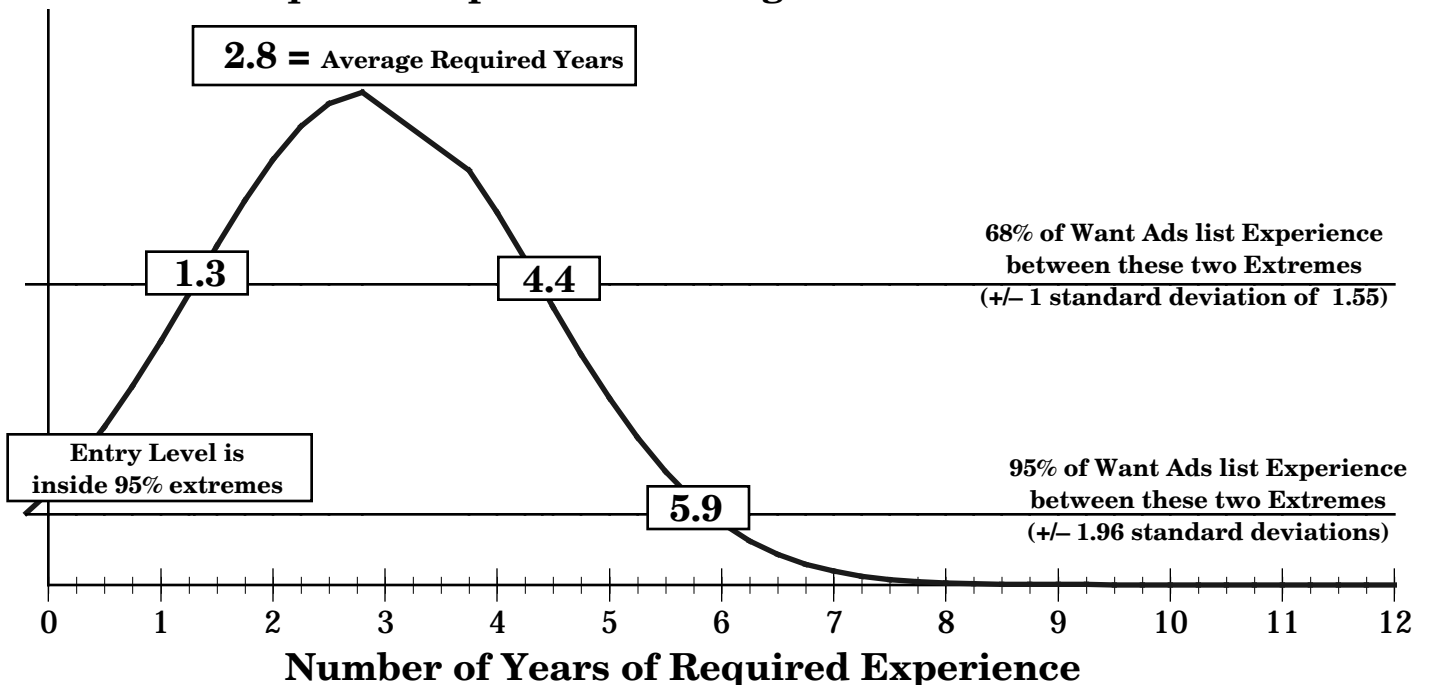
Sample Size: 70 Want Ads

Sample Source: The New York Times  
Sunday Employment section 52 Weeks from  
January 5 through December 28, 1997

## Salary Average and Distribution



## Required Experience Average and Distribution



# C/C++ & Java Programmer

## The Equation of the Expected Salary Offer

Salary offers are lowest at entry level and increase by a constant amount with each year of experience.

Salary offers were larger when UNIX and WindowsNT were listed in the want ad.

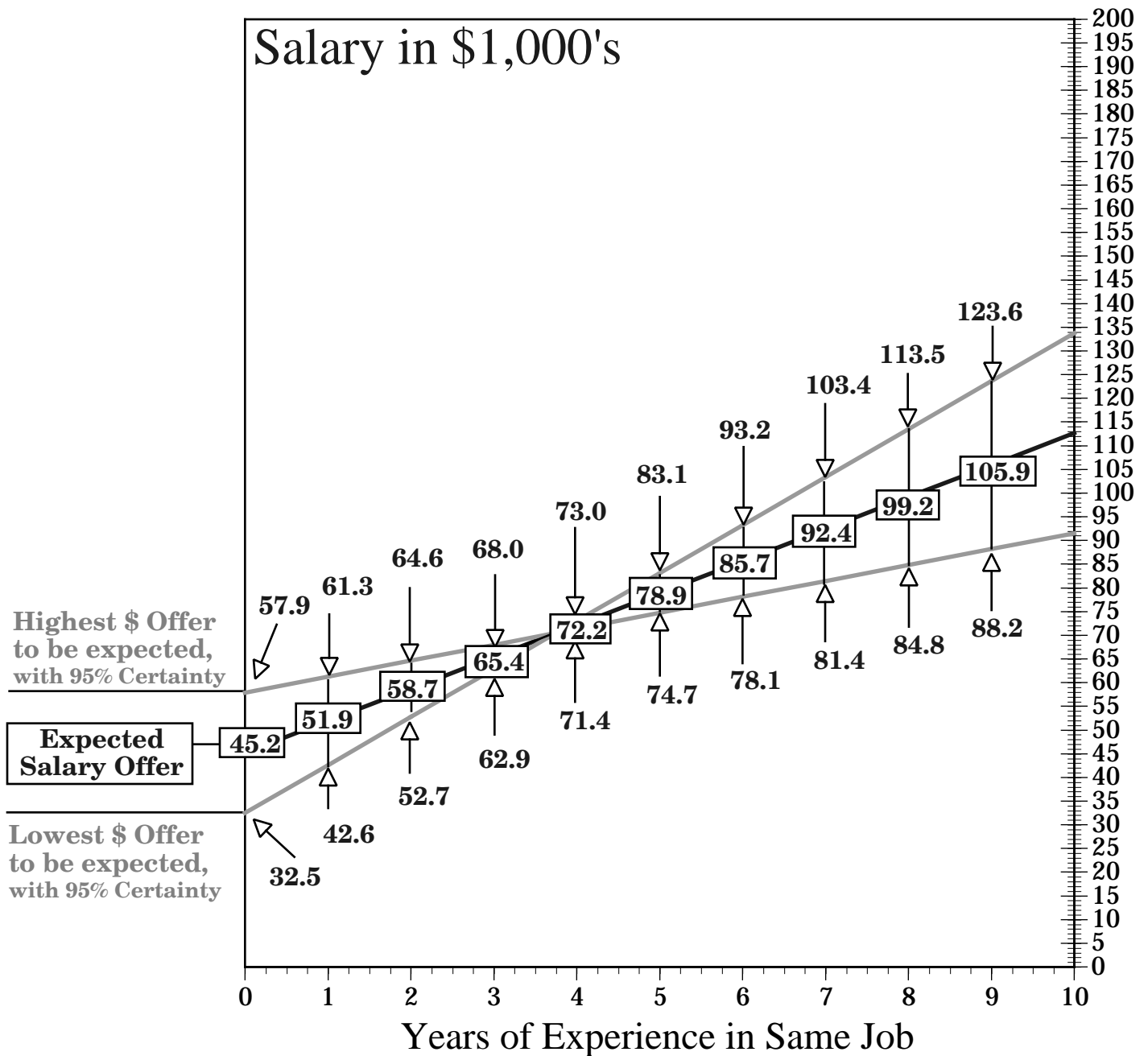
Salary offers were larger when UNIX alone was listed in the want ad.

|   |   | <b>Entry Level</b> |   | <b>UNIX &amp; WindowsNT</b>  |   | <b>UNIX Alone</b>  |   | <b>Year of Experience</b>                            |
|---|---|--------------------|---|--|---|--|---|--|
|   |   |                    |   | Effect on Salary Offer<br><b>only</b><br>when listed in position description |   | Effect on Salary Offer<br><b>only</b><br>when listed in position description |   | Dollars per Year<br>Multiplied by<br>Number of Years |
| <b>Expected Salary Offer</b>                                | = | <b>\$45.2</b>      | + | <b>\$59.7</b><br>(if UNIX & WindowsNT)<br>or<br><b>0</b>                     | + | <b>\$11.5</b><br>(if UNIX Alone)<br>or<br><b>0</b>                           | + | <b>\$6.7</b><br>Years                                |
| <b>First 95% Confidence Bound of Expected Salary Offer</b>  | = | <b>\$57.9</b>      | + | <b>\$42.1</b><br>(if UNIX & WindowsNT)<br>or<br><b>0</b>                     | + | <b>\$0.1</b><br>(if UNIX Alone)<br>or<br><b>0</b>                            | + | <b>\$3.4</b><br>Years                                |
| <b>Second 95% Confidence Bound of Expected Salary Offer</b> | = | <b>\$32.5</b>      | + | <b>\$77.4</b><br>(if UNIX & WindowsNT)<br>or<br><b>0</b>                     | + | <b>\$22.8</b><br>(if UNIX Alone)<br>or<br><b>0</b>                           | + | <b>\$10.1</b><br>Years                               |

The first and second bounds are constructed from the upper and lower 95% confidence intervals of the variables presented above. The Expected Salary Offer Graphs present the minimum confidence interval of the equation.

# C/C++ & Java Programmer

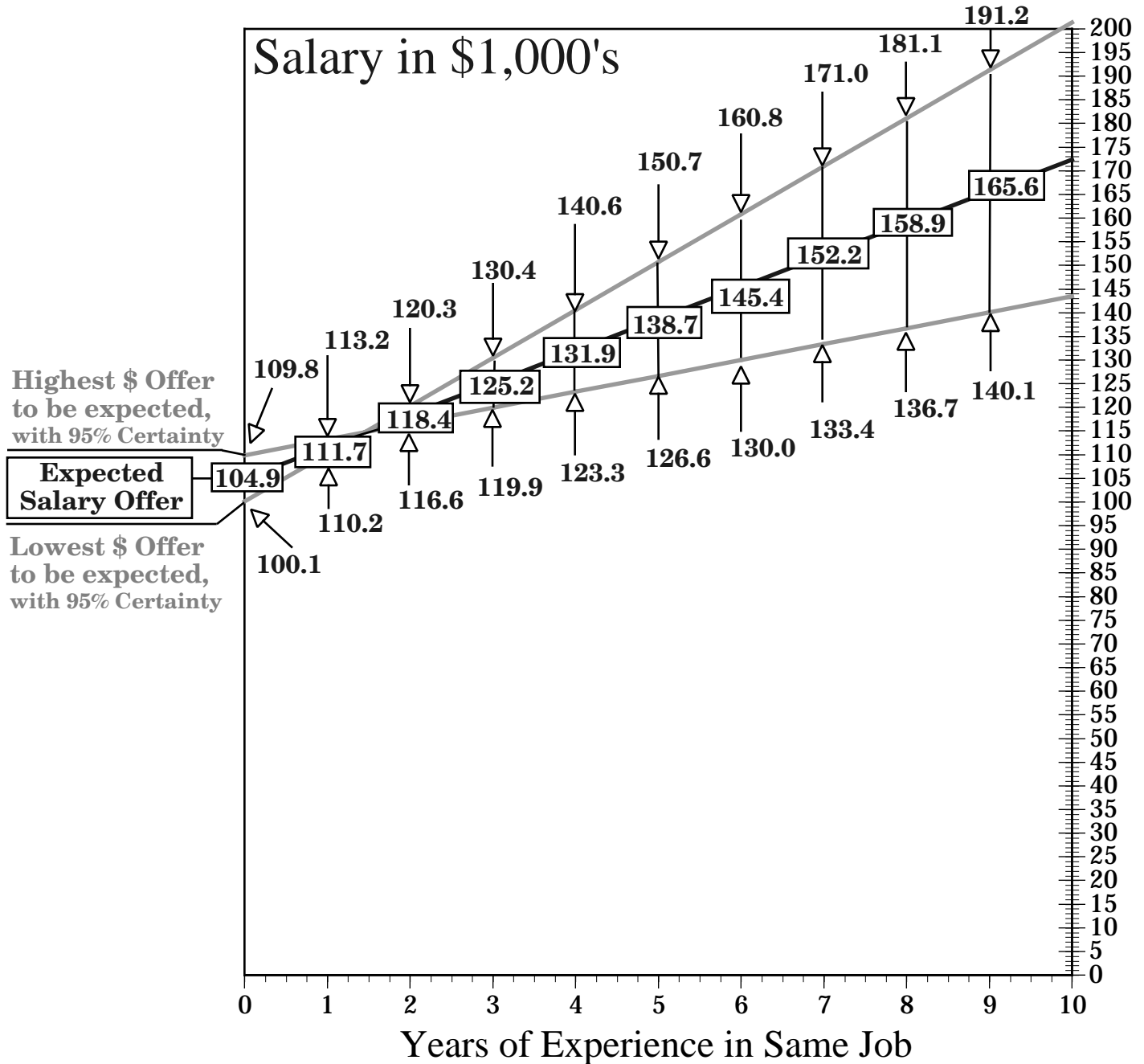
The Expected Salary Offer  
& its 95% Probability Range  
for Each Year of Required Experience



Sample Source: The New York Times  
Sunday Employment section 52 Weeks from  
January 5 through December 28, 1997

# WindowsNT & UNIX C/C++ & Java Programmer

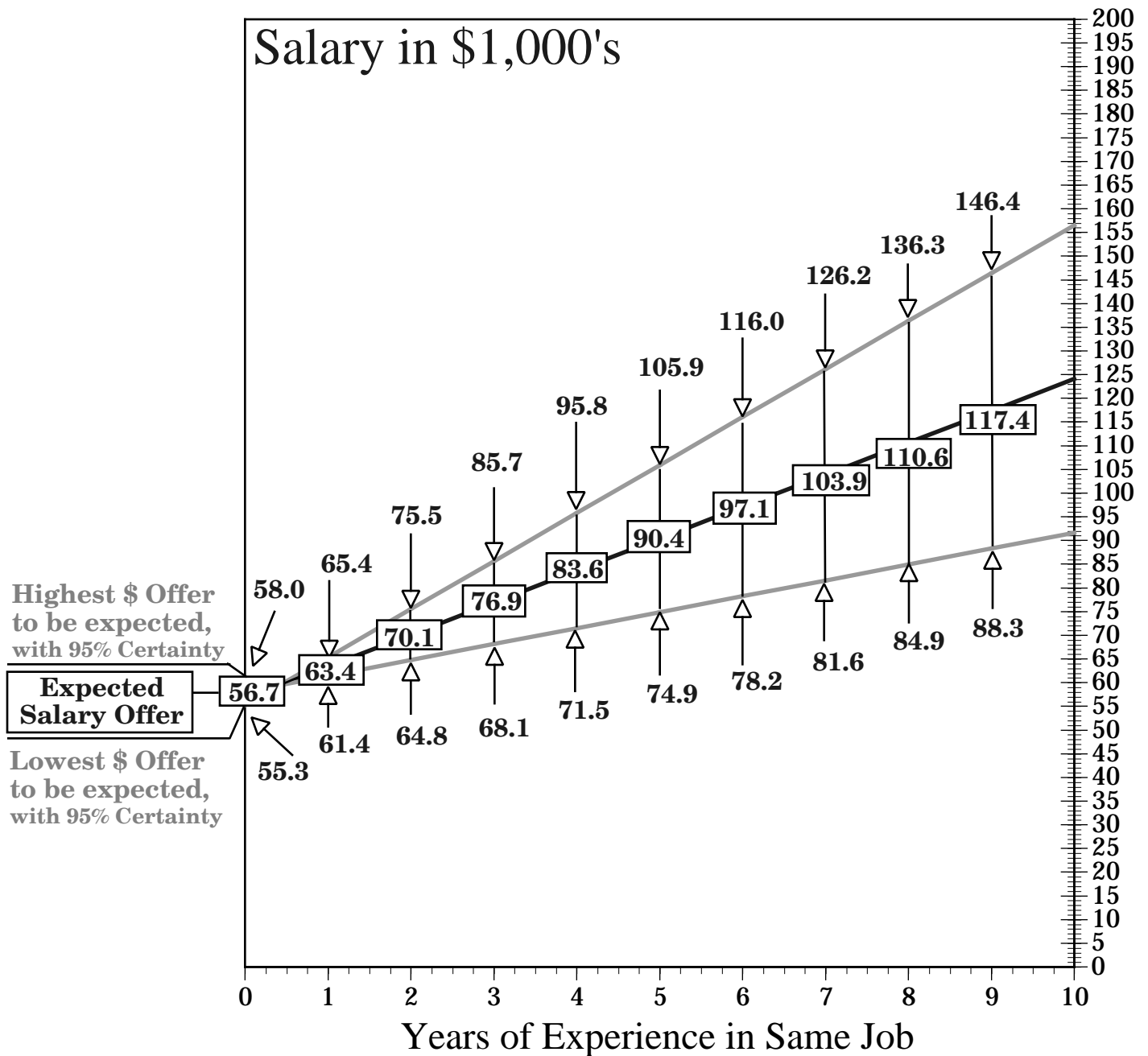
The Expected Salary Offer  
& its 95% Probability Range  
for Each Year of Required Experience



Sample Source: The New York Times  
Sunday Employment section 52 Weeks from  
January 5 through December 28, 1997

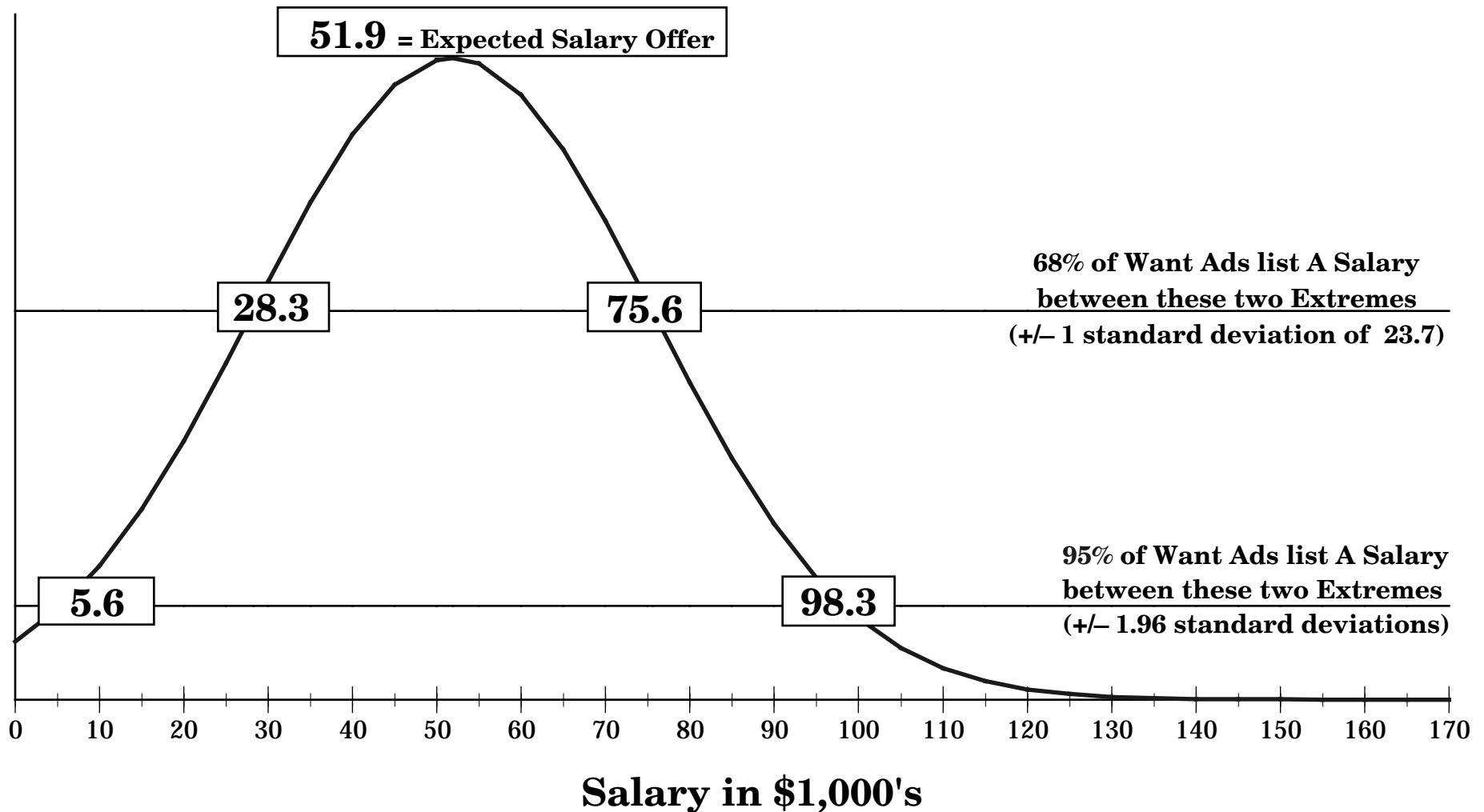
# UNIX C/C++ & Java Programmer

The Expected Salary Offer  
& its 95% Probability Range  
for Each Year of Required Experience



Sample Source: The New York Times  
Sunday Employment section 52 Weeks from  
January 5 through December 28, 1997

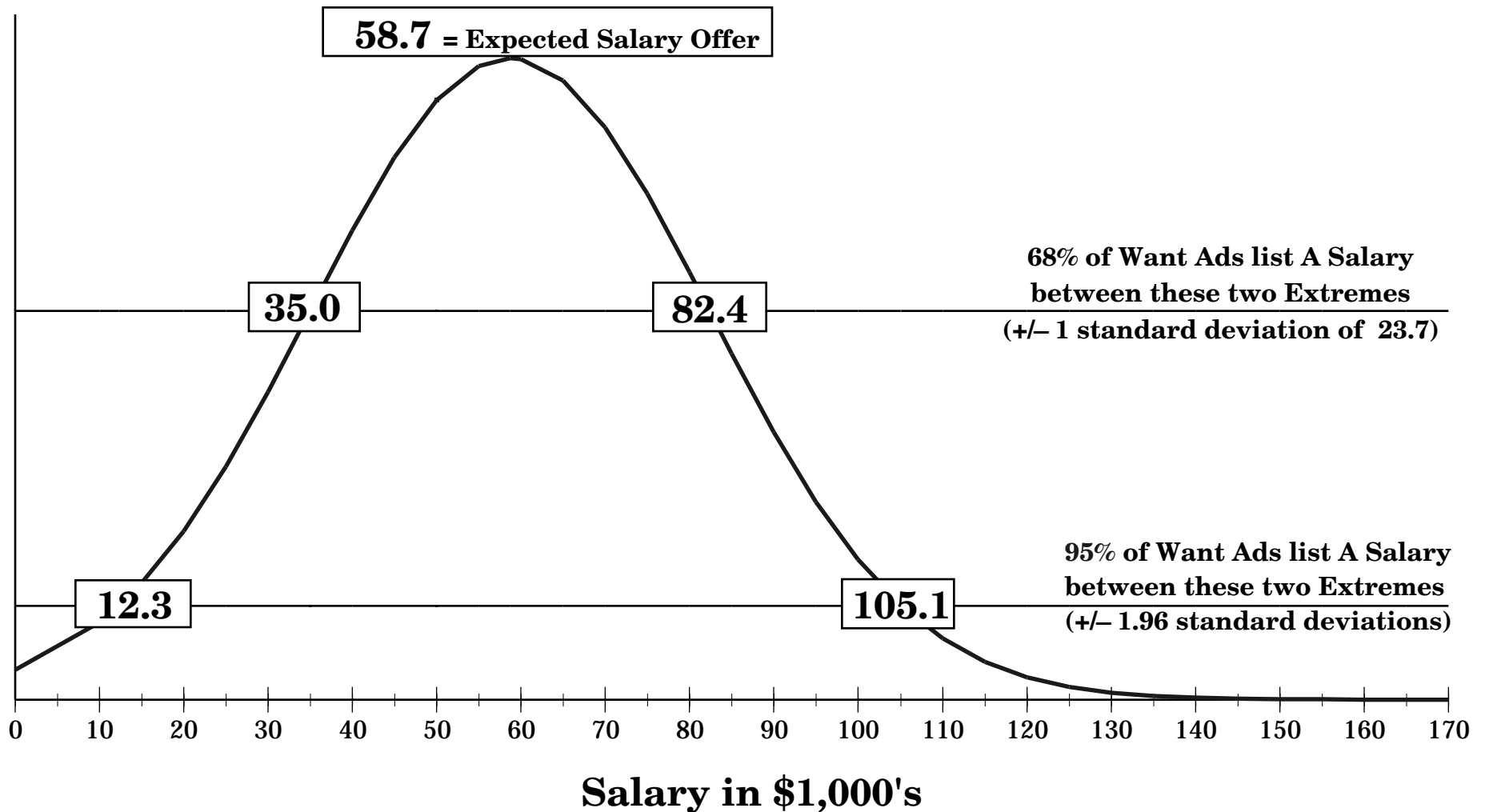
# C/C++ & Java Programmer Extreme Salary Offers: 1 Year of Required Experience



**Sample Source: The New York Times  
Sunday Employment section 52 Weeks from  
January 5 through December 28, 1997**

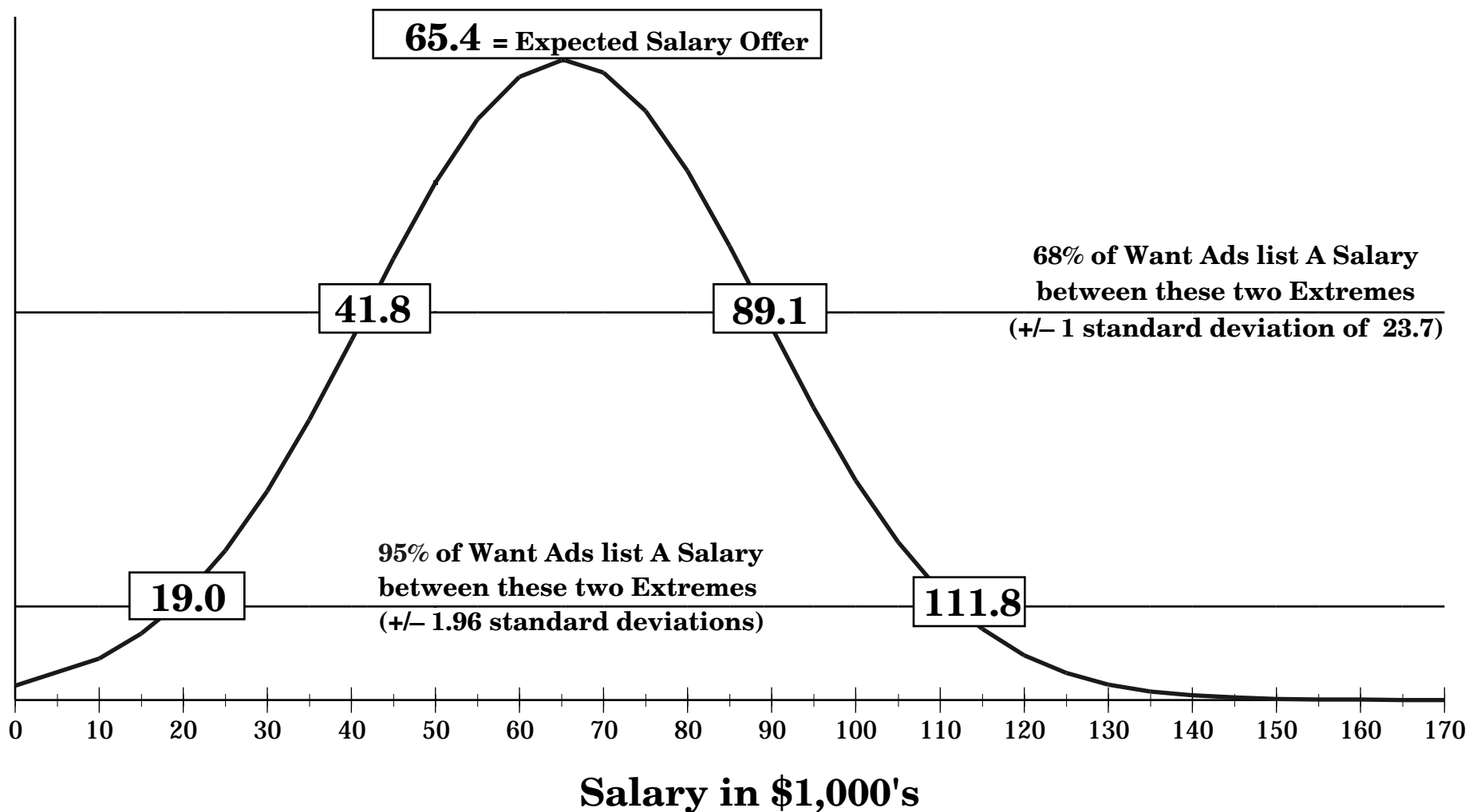
# C/C++ & Java Programmer

## Extreme Salary Offers: 2 Years of Required Experience



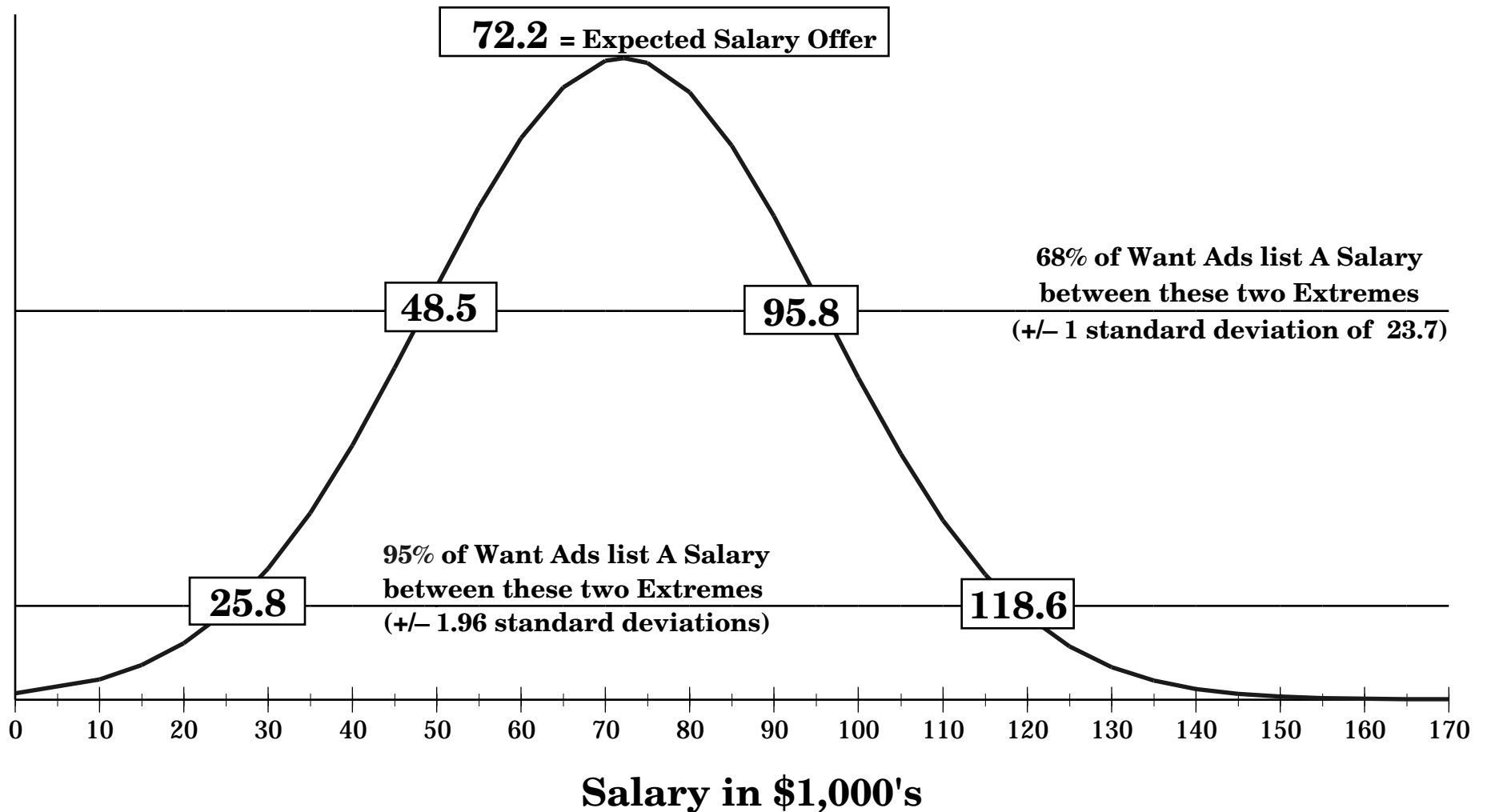
Sample Source: The New York Times  
Sunday Employment section 52 Weeks from  
January 5 through December 28, 1997

# C/C++ & Java Programmer Extreme Salary Offers: 3 Years of Required Experience



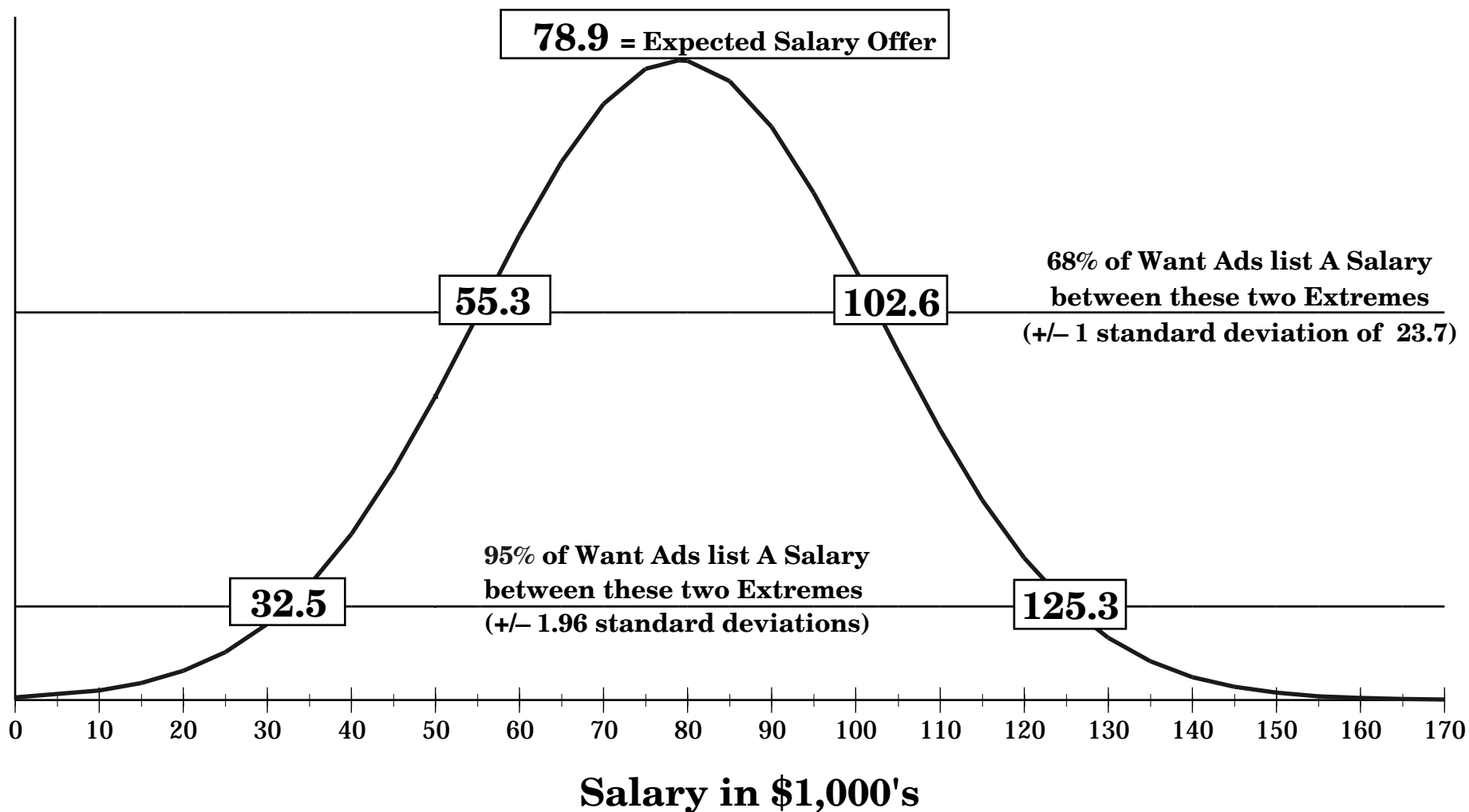
**Sample Source: The New York Times  
Sunday Employment section 52 Weeks from  
January 5 through December 28, 1997**

# C/C++ & Java Programmer Extreme Salary Offers: 4 Years of Required Experience



**Sample Source: The New York Times  
Sunday Employment section 52 Weeks from  
January 5 through December 28, 1997**

# C/C++ & Java Programmer Extreme Salary Offers: 5 Years of Required Experience



**Sample Source: The New York Times  
Sunday Employment section 52 Weeks from  
January 5 through December 28, 1997**

## **Graph Reference: Expected Salary Offer per Year of Experience**

### **The Middle Black Line**

This line depicts the expected salary offer for each year of required experience calculated from the sample of want ads.

The expected salary for each year of required experience is shown in a box on the line.

The expected salary is the most likely, and the average, salary offered.

### **The 95% Probability Lines Infer the Expected Salary Offer for the Entire Job Market**

The sample of classified want ads enables inferences to be made concerning the entire job market for this position.

The gray lines above and below the middle black line present the Highest and Lowest salary offers that can be expected in the entire job market.

There is a 95% certainty that the average salary offer, within the entire job market for this position, lies between the High and the Low numbers that point to the gray lines at each year of required experience.

### **Please Note:**

All three curves cross at the central tendency point.

The further the number of years of required experience is from the central tendency point, the larger the 95% probability region of the expected salary offer.

# Graph Reference: Extreme Salary Offers

## There are 3 statistics presented in this graph

Each statistic presents an assessment of the likelihood or frequency of a salary offer occurring:

= **Expected Salary Offer**

The expected salary offer is the most likely salary offer as calculated from the sample of want ads

**68% of Want Ads list a Salary between these two Extremes (+/- 1 standard deviation)**

The 68% probability extreme indicates the boundaries where salary offers become infrequent for the entire job market

**95% of Want Ads list a Salary between these two Extremes (+/- 1.96 standard deviations)**

The 95% probability extreme indicates the boundaries where salary offers become extremely infrequent for the entire job market

## Extreme Salaries

The 68% Probability Extremes:

Salary offers are unlikely above or below this range

Two Thirds (68%) of salary offers are in this range

Only 1/6th (16%) of salary offers are greater than the high number

Only 1/6th (16%) of salary offers are less than the low number

The 68% confidence interval is constructed by taking one standard deviation then adding it to and subtracting it from the expected salary offer

The 95% Probability Extremes

Salary offers are extremely unlikely above or below this range

95% of salary offers are in this range

Only 2.5% of salary offers are greater than the high number

Only 2.5% of salary offers are less than the low number

The 95% confidence interval is constructed by multiplying the standard deviation by 1.96 then adding it to and subtracting it from the expected salary offer

For the complete presentation of the expected salary offer please see the "Expected Salary Offer per Year of Experience" graph.

# C/C++ Java Programmer Statistical Test Results Regression Corrected for Heteroscedasticity

Regression Summary  
Salary (H Adj) vs. 4 Independents

|                    |       |
|--------------------|-------|
| Count              | 70    |
| Num. Missing       | 0     |
| R                  | .965  |
| R Squared          | .930  |
| Adjusted R Squared | .926  |
| RMS Residual       | 1.705 |

The expected salary offer line was corrected for heteroscedasticity (please view the Heteroscedasticity Correction page for specifics). A consequence of correctly accounting for the relationship within the variance is that the R Squared statistic is no longer accurate. The variation around the mean salary offer has been altered to correctly calculate the expected salary offer line with all available information.

The variability of salary offers around the Expected Salary Offer line is depicted in the 95% Probability Range of the expected salary offer and in the Extreme Salary Offer Graphs.

The R Squared statistic calculates the percentage of the variation in salary offers away from the mean salary offer, explained by the expected salary offer line. An R Squared statistic of 1 would indicate that the expected salary offer line would be the only salary offered in the marketplace. A reasonable degree of variability should be expected due to the many factors influencing individual want ads.

ANOVA Table  
Salary (H Adj) vs. 4 Independents

|            | DF | Sum of Squares | Mean Square | F-Value | P-Value |
|------------|----|----------------|-------------|---------|---------|
| Regression | 4  | 2559.067       | 639.767     | 220.182 | <.0001  |
| Residual   | 66 | 191.771        | 2.906       |         |         |
| Total      | 70 | 2750.838       |             |         |         |

Regression Coefficients  
Salary (H Adj) vs. 4 Independents

|                     | Coefficient | Std. Error | Std. Coeff. | t-Value | P-Value |
|---------------------|-------------|------------|-------------|---------|---------|
| Entry Level (H Adj) | 45.202      | 6.371      | .449        | 7.094   | <.0001  |
| UNIX&NT (H Adj)     | 59.746      | 8.819      | .674        | 6.775   | <.0001  |
| UNIX (H Adj)        | 11.457      | 5.677      | .246        | 2.018   | .0476   |
| Years (H Adj)       | 6.744       | 1.695      | .481        | 3.980   | .0002   |

The statistical significance tests indicate a high level of quality for the expected salary offer numbers:

1. There is less than a .01% (one ten-thousandth) chance that there is no relationship between salary offers and experience requirements (P-Value in ANOVA Table).
2. There is less than a .01% (one ten-thousandth) chance that the entry level salary offer can't be defined (Entry Level P-Value in Regression Coefficients Table).
3. There is less than a .02% (two ten-thousandth) chance that the yearly increase in salary offer can't be defined (Years P-Value in Regression Coefficients Table).
4. There is less than a .01% (one ten-thousandth) chance that the UNIX and WindowsNT effect can't be defined (UNIX&NT P-Value in Regression Coefficients Table).
5. There is a 4.76% chance that the UNIX effect can't be defined (UNIX P-Value in Regression Coefficients Table).

# C/C++ Java Programmer Heteroscedasticity Correction

## Heteroscedasticity Regression Test

Dependent Variable =  $\ln(\text{Resid}^2)$  Independent Variable = UNIX and WindowsNT

The variation in salary offers above and below the expected salary line is larger when "UNIX and WindowsNT" is asked for.

This additional information is factored into the analysis by dividing all columns by:

$$(e^{(4.889 + 1.263 * \text{UNIX} \& \text{WindowsNT})})^{.5}$$

When each want ad is weighted by its dependent effect on the variance, an unbiased expected salary offer line with constant variance is derived.

### Test Results

| R <sup>2</sup> Statistic |       | F Statistic  |             |                |             |         |         |
|--------------------------|-------|--------------|-------------|----------------|-------------|---------|---------|
| Count                    | 70    |              | DF          | Sum of Squares | Mean Square | F-Value | P-Value |
| Num. Missing             | 0     | Regression   | 1           | 24.055         | 24.055      | 7.811   | .0067   |
| R                        | .321  | Residual     | 68          | 209.409        | 3.080       |         |         |
| R Squared                | .103  | Total        | 69          | 233.464        |             |         |         |
| Adjusted R Squared       | .090  | t Statistics |             |                |             |         |         |
| RMS Residual             | 1.755 |              | Coefficient | Std. Error     | Std. Coeff. | t-Value | P-Value |
|                          |       | Intercept    | 4.889       | .253           | 4.889       | 19.301  | <.0001  |
|                          |       | UNIX&NT      | 1.263       | .452           | .321        | 2.795   | .0067   |

### Original Regression Test Results with Heteroscedasticity

| R <sup>2</sup> Statistic |        | F Statistic              |             |                |             |         |         |
|--------------------------|--------|--------------------------|-------------|----------------|-------------|---------|---------|
| Count                    | 70     |                          | DF          | Sum of Squares | Mean Square | F-Value | P-Value |
| Num. Missing             | 0      | Regression               | 4           | 56199.874      | 14049.968   | 24.698  | <.0001  |
| R                        | .777   | Residual                 | 65          | 36977.039      | 568.878     |         |         |
| R Squared                | .603   | Total                    | 69          | 93176.913      |             |         |         |
| Adjusted R Squared       | .579   | t Statistics             |             |                |             |         |         |
| RMS Residual             | 23.851 |                          | Coefficient | Std. Error     | Std. Coeff. | t-Value | P-Value |
|                          |        | Intercept                | 65.047      | 12.810         | 65.047      | 5.078   | <.0001  |
|                          |        | SQL                      | 14.309      | 5.955          | .196        | 2.403   | .0191   |
|                          |        | UNIX&NT                  | 48.116      | 6.476          | .612        | 7.430   | <.0001  |
|                          |        | ln(Week)                 | -8.346      | 3.537          | -.191       | -2.360  | .0213   |
|                          |        | Years                    | 8.536       | 1.898          | .360        | 4.498   | <.0001  |
|                          |        | 95% Confidence Intervals |             |                |             |         |         |
|                          |        |                          | Coefficient | 95% Lower      | 95% Upper   |         |         |
|                          |        | Intercept                | 65.047      | 39.465         | 90.630      |         |         |
|                          |        | SQL                      | 14.309      | 2.415          | 26.202      |         |         |
|                          |        | UNIX&NT                  | 48.116      | 35.182         | 61.050      |         |         |
|                          |        | ln(Week)                 | -8.346      | -15.409        | -1.282      |         |         |
|                          |        | Years                    | 8.536       | 4.746          | 12.326      |         |         |