**Below are the regression equations used to predict the IPC based upon a few selected parameters.  
In order to perform this analysis, I used the “Regression” tool under “Data Analysis” of Microsoft Excel with the IPC values I obtained from SMTSIM.  
  
applu:  
y = 0.003361\*( Queue Size) + 0.027849\*( Issue Width) + 0.000746\*( Reorder Buffer) + 0.47921  
  
apsi:  
y = 0.002563\*( Queue Size) - 0.0018\*( Issue Width) + 0.000448\*( Reorder Buffer) -0.04182**

**art\_470:  
y = 0.001619\*( Queue Size) + 0.106921\*( Issue Width) + 0.000239\*( Reorder Buffer) + 0.596732  
  
bwaves\_06:  
y = 0.002327\*( Queue Size) + 0.007492\*( Issue Width) + 0.000477\*( Reorder Buffer) + 0.105797  
  
bzip2\_source:  
y = 0.000317\*( Queue Size) + 0.000317\*( Issue Width) + 0.000073\*( Reorder Buffer) + 0.052844035  
  
cactusADM\_06:  
y = 0.000456\*( Queue Size) + 0.056079\*( Issue Width) + 0.000045\*( Reorder Buffer) + 0.65109966**

**Our parameters three main parameters are the following sub-parameters which we set to all the same size for each given value:  
loadstore\_queue\_size, int\_queue\_size, float\_queue\_size parameter modifications for Queue Size,  
max\_int\_issue, max\_float\_issue, and max\_ldst\_issue parameter modifications for Issue Width,  
and int\_rename\_regs, float\_rename\_regs, reorder\_buffer\_size for Reorder Buffer.  
  
From analyzing the regression equations, we find that the issue width has the greatest influence over our value of the IPC for all of the benchmarks except for apsi. For apsi, the parameter with the greatest influence is the queue size. The parameter with the least influence over the IPC for every benchmark is the reorder buffer parameter.**

**Below are my tables indicating my IPC that I determined from using SMTSIM, as well as the approximated IPC values from using my regression formula, and finally the residual of the two values, given the current input values listed at the left:  
  
  
  
applu:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x^1 | x^2 | x^3 |  |  |  |
| Queue Size | Issue Width | Reorder Buffer | IPC | Approximated | Residual |
| 8 | 1 | 32 | 0.662 | 0.557824692 | 0.104175308 |
| 8 | 1 | 96 | 0.662 | 0.605584045 | 0.056415955 |
| 8 | 1 | 512 | 0.662 | 0.916019835 | -0.254019835 |
| 8 | 2 | 32 | 0.685 | 0.585673899 | 0.099326101 |
| 8 | 2 | 96 | 0.685 | 0.633433251 | 0.051566749 |
| 8 | 2 | 512 | 0.685 | 0.943869041 | -0.258869041 |
| 8 | 4 | 32 | 0.685 | 0.641372311 | 0.043627689 |
| 8 | 4 | 96 | 0.685 | 0.689131664 | -0.004131664 |
| 8 | 4 | 512 | 0.685 | 0.999567454 | -0.314567454 |
| 32 | 1 | 32 | 0.729 | 0.638483422 | 0.090516578 |
| 32 | 1 | 96 | 0.84 | 0.686242775 | 0.153757225 |
| 32 | 1 | 512 | 0.863 | 0.996678565 | -0.133678565 |
| 32 | 2 | 32 | 0.744 | 0.666332629 | 0.077667371 |
| 32 | 2 | 96 | 0.968 | 0.714091981 | 0.253908019 |
| 32 | 2 | 512 | 1.011 | 1.024527771 | -0.013527771 |
| 32 | 4 | 32 | 0.751 | 0.722031041 | 0.028968959 |
| 32 | 4 | 96 | 0.971 | 0.769790394 | 0.201209606 |
| 32 | 4 | 512 | 1.017 | 1.080226184 | -0.063226184 |
| 128 | 1 | 32 | 0.729 | 0.961118343 | -0.232118343 |
| 128 | 1 | 96 | 0.86 | 1.008877695 | -0.148877695 |
| 128 | 1 | 512 | 1.459 | 1.319313485 | 0.139686515 |
| 128 | 2 | 32 | 0.744 | 0.988967549 | -0.244967549 |
| 128 | 2 | 96 | 0.969 | 1.036726902 | -0.067726902 |
| 128 | 2 | 512 | 1.786 | 1.347162692 | 0.438837308 |
| 128 | 4 | 32 | 0.751 | 1.044665962 | -0.293665962 |
| 128 | 4 | 96 | 0.973 | 1.092425314 | -0.119425314 |
| 128 | 4 | 512 | 1.812 | 1.402861104 | 0.409138896 |

**apsi:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x^1 | x^2 | x^3 |  |  |  |
| Queue Size | Issue Width | Reorder Buffer | IPC | *Predicted IPC* | *Residuals* |
| 8 | 1 | 32 | 0.05 | -0.007161894 | 0.057161894 |
| 8 | 1 | 96 | 0.05 | 0.021505889 | 0.028494111 |
| 8 | 1 | 512 | 0.05 | 0.207846481 | -0.157846481 |
| 8 | 2 | 32 | 0.05 | -0.007344434 | 0.057344434 |
| 8 | 2 | 96 | 0.05 | 0.02132335 | 0.02867665 |
| 8 | 2 | 512 | 0.05 | 0.207663941 | -0.157663941 |
| 8 | 4 | 32 | 0.05 | -0.007709513 | 0.057709513 |
| 8 | 4 | 96 | 0.05 | 0.02095827 | 0.02904173 |
| 8 | 4 | 512 | 0.05 | 0.207298862 | -0.157298862 |
| 32 | 1 | 32 | 0.1 | 0.054353979 | 0.045646021 |
| 32 | 1 | 96 | 0.198 | 0.083021762 | 0.114978238 |
| 32 | 1 | 512 | 0.198 | 0.269362354 | -0.071362354 |
| 32 | 2 | 32 | 0.1 | 0.054171439 | 0.045828561 |
| 32 | 2 | 96 | 0.198 | 0.082839223 | 0.115160777 |
| 32 | 2 | 512 | 0.198 | 0.269179814 | -0.071179814 |
| 32 | 4 | 32 | 0.1 | 0.05380636 | 0.04619364 |
| 32 | 4 | 96 | 0.197 | 0.082474143 | 0.114525857 |
| 32 | 4 | 512 | 0.197 | 0.268814735 | -0.071814735 |
| 128 | 1 | 32 | 0.1 | 0.300417471 | -0.200417471 |
| 128 | 1 | 96 | 0.297 | 0.329085254 | -0.032085254 |
| 128 | 1 | 512 | 0.731 | 0.515425846 | 0.215574154 |
| 128 | 2 | 32 | 0.1 | 0.300234931 | -0.200234931 |
| 128 | 2 | 96 | 0.297 | 0.328902715 | -0.031902715 |
| 128 | 2 | 512 | 0.729 | 0.515243306 | 0.213756694 |
| 128 | 4 | 32 | 0.1 | 0.299869852 | -0.199869852 |
| 128 | 4 | 96 | 0.297 | 0.328537635 | -0.031537635 |
| 128 | 4 | 512 | 0.728 | 0.514878227 | 0.213121773 |

**art\_470:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x^1 | x^2 | x^3 |  |  |  |
| Queue Size | Issue Width | Reorder Buffer | IPC | *Predicted IPC* | *Residuals* |
| 8 | 1 | 32 | 0.716 | 0.724245527 | -0.008245527 |
| 8 | 1 | 96 | 0.716 | 0.739525817 | -0.023525817 |
| 8 | 1 | 512 | 0.716 | 0.838847704 | -0.122847704 |
| 8 | 2 | 32 | 0.917 | 0.831166161 | 0.085833839 |
| 8 | 2 | 96 | 0.917 | 0.846446452 | 0.070553548 |
| 8 | 2 | 512 | 0.917 | 0.945768339 | -0.028768339 |
| 8 | 4 | 32 | 0.934 | 1.045007431 | -0.111007431 |
| 8 | 4 | 96 | 0.934 | 1.060287722 | -0.126287722 |
| 8 | 4 | 512 | 0.934 | 1.159609609 | -0.225609609 |
| 32 | 1 | 32 | 0.732 | 0.763102669 | -0.031102669 |
| 32 | 1 | 96 | 0.761 | 0.77838296 | -0.01738296 |
| 32 | 1 | 512 | 0.761 | 0.877704847 | -0.116704847 |
| 32 | 2 | 32 | 1.054 | 0.870023304 | 0.183976696 |
| 32 | 2 | 96 | 1.158 | 0.885303595 | 0.272696405 |
| 32 | 2 | 512 | 1.158 | 0.984625482 | 0.173374518 |
| 32 | 4 | 32 | 1.083 | 1.083864574 | -0.000864574 |
| 32 | 4 | 96 | 1.223 | 1.099144865 | 0.123855135 |
| 32 | 4 | 512 | 1.223 | 1.198466752 | 0.024533248 |
| 128 | 1 | 32 | 0.732 | 0.918531241 | -0.186531241 |
| 128 | 1 | 96 | 0.764 | 0.933811531 | -0.169811531 |
| 128 | 1 | 512 | 0.945 | 1.033133418 | -0.088133418 |
| 128 | 2 | 32 | 1.054 | 1.025451876 | 0.028548124 |
| 128 | 2 | 96 | 1.163 | 1.040732166 | 0.122267834 |
| 128 | 2 | 512 | 1.378 | 1.140054053 | 0.237945947 |
| 128 | 4 | 32 | 1.083 | 1.239293146 | -0.156293146 |
| 128 | 4 | 96 | 1.228 | 1.254573436 | -0.026573436 |
| 128 | 4 | 512 | 1.47 | 1.353895323 | 0.116104677 |

**bwaves\_06:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x^1 | x^2 | x^3 |  |  |  |
| Queue Size | Issue Width | Reorder Buffer | IPC | *Predicted IPC* | *Residuals* |
| 8 | 1 | 32 | 0.23 | 0.147171745 | 0.082828255 |
| 8 | 1 | 96 | 0.23 | 0.177704967 | 0.052295033 |
| 8 | 1 | 512 | 0.23 | 0.376170907 | -0.146170907 |
| 8 | 2 | 32 | 0.25 | 0.154663808 | 0.095336192 |
| 8 | 2 | 96 | 0.25 | 0.18519703 | 0.06480297 |
| 8 | 2 | 512 | 0.25 | 0.383662971 | -0.133662971 |
| 8 | 4 | 32 | 0.252 | 0.169647935 | 0.082352065 |
| 8 | 4 | 96 | 0.252 | 0.200181157 | 0.051818843 |
| 8 | 4 | 512 | 0.252 | 0.398647098 | -0.146647098 |
| 32 | 1 | 32 | 0.25 | 0.203020951 | 0.046979049 |
| 32 | 1 | 96 | 0.308 | 0.233554173 | 0.074445827 |
| 32 | 1 | 512 | 0.308 | 0.432020114 | -0.124020114 |
| 32 | 2 | 32 | 0.272 | 0.210513015 | 0.061486985 |
| 32 | 2 | 96 | 0.319 | 0.241046236 | 0.077953764 |
| 32 | 2 | 512 | 0.319 | 0.439512177 | -0.120512177 |
| 32 | 4 | 32 | 0.274 | 0.225497142 | 0.048502858 |
| 32 | 4 | 96 | 0.321 | 0.256030363 | 0.064969637 |
| 32 | 4 | 512 | 0.321 | 0.454496304 | -0.133496304 |
| 128 | 1 | 32 | 0.25 | 0.426417777 | -0.176417777 |
| 128 | 1 | 96 | 0.364 | 0.456950998 | -0.092950998 |
| 128 | 1 | 512 | 0.879 | 0.655416939 | 0.223583061 |
| 128 | 2 | 32 | 0.272 | 0.43390984 | -0.16190984 |
| 128 | 2 | 96 | 0.382 | 0.464443062 | -0.082443062 |
| 128 | 2 | 512 | 0.951 | 0.662909003 | 0.288090997 |
| 128 | 4 | 32 | 0.274 | 0.448893967 | -0.174893967 |
| 128 | 4 | 96 | 0.379 | 0.479427189 | -0.100427189 |
| 128 | 4 | 512 | 0.956 | 0.67789313 | 0.27810687 |

**bzip2\_source:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x^1 | x^2 | x^3 |  |  |  |
| Queue Size | Issue Width | Reorder Buffer | IPC | *Predicted IPC* | *Residuals* |
| 8 | 1 | 32 | 0.06 | 0.058041504 | 0.001958496 |
| 8 | 1 | 96 | 0.06 | 0.062732738 | -0.002732738 |
| 8 | 1 | 512 | 0.06 | 0.093225758 | -0.033225758 |
| 8 | 2 | 32 | 0.061 | 0.058358964 | 0.002641036 |
| 8 | 2 | 96 | 0.061 | 0.063050198 | -0.002050198 |
| 8 | 2 | 512 | 0.061 | 0.093543219 | -0.032543219 |
| 8 | 4 | 32 | 0.061 | 0.058993885 | 0.002006115 |
| 8 | 4 | 96 | 0.061 | 0.063685119 | -0.002685119 |
| 8 | 4 | 512 | 0.061 | 0.094178139 | -0.033178139 |
| 32 | 1 | 32 | 0.061 | 0.065644678 | -0.004644678 |
| 32 | 1 | 96 | 0.108 | 0.070335912 | 0.037664088 |
| 32 | 1 | 512 | 0.108 | 0.100828933 | 0.007171067 |
| 32 | 2 | 32 | 0.061 | 0.065962139 | -0.004962139 |
| 32 | 2 | 96 | 0.11 | 0.070653373 | 0.039346627 |
| 32 | 2 | 512 | 0.11 | 0.101146393 | 0.008853607 |
| 32 | 4 | 32 | 0.061 | 0.066597059 | -0.005597059 |
| 32 | 4 | 96 | 0.11 | 0.071288293 | 0.038711707 |
| 32 | 4 | 512 | 0.11 | 0.101781314 | 0.008218686 |
| 128 | 1 | 32 | 0.061 | 0.096057377 | -0.035057377 |
| 128 | 1 | 96 | 0.108 | 0.100748611 | 0.007251389 |
| 128 | 1 | 512 | 0.15 | 0.131241631 | 0.018758369 |
| 128 | 2 | 32 | 0.061 | 0.096374837 | -0.035374837 |
| 128 | 2 | 96 | 0.11 | 0.101066071 | 0.008933929 |
| 128 | 2 | 512 | 0.151 | 0.131559092 | 0.019440908 |
| 128 | 4 | 32 | 0.061 | 0.097009758 | -0.036009758 |
| 128 | 4 | 96 | 0.11 | 0.101700992 | 0.008299008 |
| 128 | 4 | 512 | 0.151 | 0.132194012 | 0.018805988 |

**cactusADM\_06:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x^1 | x^2 | x^3 |  |  |  |
| Queue Size | Issue Width | Reorder Buffer | IPC | *Predicted IPC* | *Residuals* |
| 8 | 1 | 32 | 0.67 | 0.712281673 | -0.042281673 |
| 8 | 1 | 96 | 0.67 | 0.715190662 | -0.045190662 |
| 8 | 1 | 512 | 0.67 | 0.734099093 | -0.064099093 |
| 8 | 2 | 32 | 0.823 | 0.768361038 | 0.054638962 |
| 8 | 2 | 96 | 0.823 | 0.771270027 | 0.051729973 |
| 8 | 2 | 512 | 0.823 | 0.790178458 | 0.032821542 |
| 8 | 4 | 32 | 0.834 | 0.880519768 | -0.046519768 |
| 8 | 4 | 96 | 0.834 | 0.883428758 | -0.049428758 |
| 8 | 4 | 512 | 0.834 | 0.902337189 | -0.068337189 |
| 32 | 1 | 32 | 0.687 | 0.723226117 | -0.036226117 |
| 32 | 1 | 96 | 0.703 | 0.726135107 | -0.023135107 |
| 32 | 1 | 512 | 0.703 | 0.745043538 | -0.042043538 |
| 32 | 2 | 32 | 0.875 | 0.779305482 | 0.095694518 |
| 32 | 2 | 96 | 0.9 | 0.782214472 | 0.117785528 |
| 32 | 2 | 512 | 0.9 | 0.801122903 | 0.098877097 |
| 32 | 4 | 32 | 0.886 | 0.891464213 | -0.005464213 |
| 32 | 4 | 96 | 0.911 | 0.894373202 | 0.016626798 |
| 32 | 4 | 512 | 0.912 | 0.913281633 | -0.001281633 |
| 128 | 1 | 32 | 0.687 | 0.767003895 | -0.080003895 |
| 128 | 1 | 96 | 0.708 | 0.769912885 | -0.061912885 |
| 128 | 1 | 512 | 0.73 | 0.788821316 | -0.058821316 |
| 128 | 2 | 32 | 0.875 | 0.82308326 | 0.05191674 |
| 128 | 2 | 96 | 0.906 | 0.82599225 | 0.08000775 |
| 128 | 2 | 512 | 0.942 | 0.844900681 | 0.097099319 |
| 128 | 4 | 32 | 0.886 | 0.93524199 | -0.04924199 |
| 128 | 4 | 96 | 0.918 | 0.93815098 | -0.02015098 |
| 128 | 4 | 512 | 0.954 | 0.957059411 | -0.003059411 |