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/*****
* Ad Testing
* @version: 4.0
* @author: KlientBoost
*****/

var EXTRA_LOGS = false;
var CONFIDENCE_LEVEL = 90; // 90%, 95%, or 99% are most common

//If you only want to run on some campaigns, apply a label to them
//and put the name of the label here. Leave blank to run on all campaigns.
var CAMPAIGN_LABEL = "";
var ADGROUP_LABEL = "";

var LAST_N_DAYS = 60;

//These two metrics are the components that make up the metric you
//want to compare. For example, this measures CTR = Clicks/Impressions
//Other examples might be:
// Cost Per Conv = Cost/Conversions
// Conversion Rate = Conversions/Clicks
// Cost Per Click = Cost/Clicks
var VISITORS_METRIC = 'Clicks';
var CONVERSIONS_METRIC = 'Conversions';
//This is the number of impressions the Ad needs to have in order
//to start measuring the results of a test.
var VISITORS_THRESHOLD = 10;

var LOSER_LABEL = 'Loser '+CONFIDENCE_LEVEL+'% Confidence';
var CHAMPION_LABEL = 'Winner';

function main() {

    var winnerIds = [], loserIds = [];
    var adMap = groupAdsByAdGroup();

    for(var agId in adMap) {
        var ads = adMap[agId];
        ads = ads.sort(function(a,b){return b[VISITORS_METRIC] - a[VISITORS_METRIC]});

        var controlAd = "";
        for(var x in ads) {

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        if(ads[x].Labels.indexOf(CHAMPION_LABEL) > -1) {
            controlAd = ads[x];
            break
        }
    }

    if(!controlAd) {
        controlAd = ads.shift();
    }

    var winnerFound = false;
    for(var adIndex in ads) {
        var testAd = ads[adIndex];
        if(testAd.Id == controlAd.Id) { continue; }

        var test = new
Test(controlAd,testAd,CONFIDENCE_LEVEL,VISITORS_METRIC,CONVERSIONS_METRIC);

        //Check for significance
        if(test.isSignificant()) {
            var loser = test.getLoser();
            loserIds.push([agId, loser.Id]);

            //The winner is the new control. Could be the same as the old one.
            controlAd = test.getWinner();
            winnerFound = true;
        }
    }

    if(winnerFound) {
        winnerIds.push([agId, controlAd.Id]);
    }
}

refreshLabel(LOSER_LABEL, "#FFA398");
refreshLabel(CHAMPION_LABEL, "#AFFF9F");

if(winnerIds.length) {
    var iter = AdWordsApp.ads().withIds(winnerIds).get();
    while(iter.hasNext()) {
        var ad = iter.next()
        ad.applyLabel(CHAMPION_LABEL);
    }
}

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}

if(loserIds.length) {
  var iter = AdWordsApp.ads().withIds(loserIds).get();
  while(iter.hasNext()) {
    var ad = iter.next();
    ad.applyLabel(LOSER_LABEL);
  }
}
}

function groupAdsByAdGroup() {
  var campIds = [];
  if(CAMPAIGN_LABEL) {
    getCampaignIds(campIds);
  }

  var agIds = [];
  if(ADGROUP_LABEL) {
    getAdGroupIds(campIds, agIds);
  }

  var DATE_RANGE = getAdWordsFormattedDate(LAST_N_DAYS, 'yyyyMMdd') + ',' +
getAdWordsFormattedDate(1, 'yyyyMMdd');
  var OPTIONS = { includeZeroImpressions : true };

  var cols = ['AdGroupId','Id','Labels','Clicks','Impressions','Cost','Conversions'];
  var report = 'AD_PERFORMANCE_REPORT';
  var query = ['select',cols.join(','),'from',report,
    'where AdType != TEXT_AD',
    'and Status = ENABLED',
    campIds.length ? 'and CampaignId IN [' + campIds.join(',') + ']' : '',
    agIds.length ? 'and AdGroupId IN [' + agIds.join(',') + ']' : '',
    'and Clicks >= ' + VISITORS_THRESHOLD,
    'during',DATE_RANGE].join(' ');

  var report = AdWordsApp.report(query, OPTIONS).rows();

  var map = {};
  while (report.hasNext()) {
    var row = report.next();
    var key = [row.AdGroupId, row.Id].join('-');
    if(!map[row.AdGroupId]) {

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        map[row.AdGroupId] = [];
    }

    var adRow = {
        'IdKey': key,
        'AdGroupId': row.AdGroupId,
        'Id': row.Id,
        'Impressions': parseInt(row.Impressions, 10),
        'Clicks': parseInt(row.Clicks, 10),
        'Conversions': parseFloat(row.Conversions.toString().replace(/,/g,"")),
        'Cost': parseFloat(row.Conversions.toString().replace(/,/g,"")),
        'Labels': row.Labels
    };

    map[row.AdGroupId].push(adRow);
}

return map;
}

function getCampaignIds(campIds) {
    var iter = AdWordsApp.campaigns().withCondition("LabelNames CONTAINS_ANY [" + CAMPAIGN_LABEL + "]").get();
    if(iter.hasNext()) {
        campIds.push(iter.next().getId());
    }
    return campIds;
}

function getAdGroupIds(campIds, ids) {
    var iter = AdWordsApp.adGroups()
        .withCondition("LabelNames CONTAINS_ANY [" + ADGROUP_LABEL + "]");

    if(campIds) {
        iter.withCondition('CampaignId IN [' + campIds.join(',') + ']');
    }

    iter = iter.get();
    if(iter.hasNext()) {
        ids.push(iter.next().getId());
    }

    return ids;
}

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}

function applyLabel(entity,label) {
    entity.applyLabel(label);
}

function removeLabel(ad,label) {
    ad.removeLabel(label);
}

function refreshLabel(name, color) {
    if(AdWordsApp.labels().withCondition("Name = '"+name+"'").get().hasNext()) {
        AdWordsApp.labels().withCondition("Name = '"+name+"'").get().next().remove();
    }

    AdWordsApp.createLabel(name,"",color);
}

// A helper function to create a new label if it doesn't exist in the account.
function createLabelIfNeeded(name,color) {
    if(!AdWordsApp.labels().withCondition("Name = '"+name+"'").get().hasNext()) {
        info("Creating label: '"+name+"'");
        AdWordsApp.createLabel(name,"",color);
    } else {
        info("Label: '"+name+"' already exists.");
    }
}

//Helper function to format the date
function getDateString(date,format) {
    return Utilities.formatDate(new
Date(date),AdWordsApp.currentAccount().getTimeZone(),format);
}

// Helper function to print info logs
function info(msg) {
    if(EXTRA_LOGS) {
        Logger.log('INFO: '+msg);
    }
}

// Helper function to print more serious warnings
function warn(msg) {

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    Logger.log('WARNING: '+msg);
}

/*****
* Test: A class for running A/B Tests for Ads
* Version 1.0
* Based on VisualWebsiteOptimizer logic: http://goo.gl/jilmn
*****/

// A description of the parameters:
// control - the control Ad, test - the test Ad
// startDate, endDate - the start and end dates for the test
// visitorMetric, conversionMetric - the components of the metric to use for the test
function Test(control,test,desiredConf,visitorMetric,conversionMetric) {
    this.desiredConfidence = desiredConf/100;
    this.verMetric = visitorMetric;
    this.conMetric = conversionMetric;
    this.winner;

    this.controlAd = control;
    this.controlVisitors = this.controlAd[this.verMetric];
    this.controlConversions = this.controlAd[this.conMetric];
    this.controlCR = getConversionRate(this.controlVisitors,this.controlConversions);

    this.testAd = test;
    this.testVisitors = this.testAd[this.verMetric];
    this.testConversions = this.testAd[this.conMetric];
    this.testCR = getConversionRate(this.testVisitors,this.testConversions);

    this.pValue;

    this.getControlVisitors = function() { return this.controlVisitors; }
    this.getControlConversions = function() { return this.controlConversions; }
    this.getTestVisitors = function() { return this.testVisitors; }
    this.getTestConversions = function() { return this.testConversions; }

    // Returns the P-Value for the two Ads
    this.getPValue = function() {
        if(!this.pValue) {
            this.pValue = calculatePValue(this);
        }
        return this.pValue;
    };
};

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// Determines if the test has hit significance
this.isSignificant = function() {
    var pValue = this.getPValue();
    if(pValue && pValue !== 'N/A' && (pValue >= this.desiredConfidence || pValue <= (1 -
this.desiredConfidence))) {
        return true;
    }
    return false;
}

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// Returns the winning Ad
this.getWinner = function() {
    if(this.decideWinner() === 'control') {
        return this.controlAd;
    }
    if(this.decideWinner() === 'challenger') {
        return this.testAd;
    }
    return null;
};

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// Returns the losing Ad
this.getLoser = function() {
    if(this.decideWinner() === 'control') {
        return this.testAd;
    }
    if(this.decideWinner() === 'challenger') {
        return this.controlAd;
    }
    return null;
};

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// Determines if the control or the challenger won
this.decideWinner = function () {
    if(this.winner) {
        return this.winner;
    }
    if(this.isSignificant()) {
        if(this.controlCR >= this.testCR) {
            this.winner = 'control';
        } else {
            this.winner = 'challenger';
        }
    }
}

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    } else {
        this.winner = 'no winner';
    }
    return this.winner;
}

// This function returns the confidence level for the test
function calculatePValue(instance) {
    var control = {
        visitors: instance.controlVisitors,
        conversions: instance.controlConversions,
        cr: instance.controlCR
    };
    var challenger = {
        visitors: instance.testVisitors,
        conversions: instance.testConversions,
        cr: instance.testCR
    };
    var z = getZScore(control, challenger);
    if(z == -1) { return 'N/A'; }
    var norm = normSDist(z);
    return norm;
}

// A helper function to make rounding a little easier
function round(value) {
    var decimals = Math.pow(10,5);
    return Math.round(value*decimals)/decimals;
}

// Return the conversion rate for the test
function getConversionRate(visitors, conversions) {
    if(visitors == 0) {
        return -1;
    }
    return conversions/visitors;
}

function getStandardError(cr, visitors) {
    if(visitors == 0) {
        throw 'Visitors cannot be 0.';
    }
    return Math.sqrt((cr*(1-cr)/visitors));
}

```

```
}
```

```
function getZScore(c,t) {
```

```
  try {  
    if(!c['se']) { c['se'] = getStandardError(c.cr,c.visitors); }  
    if(!t['se']) { t['se'] = getStandardError(t.cr,t.visitors); }  
  } catch(e) {  
    Logger.log(e);  
    return -1;  
  }
```

```
  if((Math.sqrt(Math.pow(c.se,2)+Math.pow(t.se,2))) == 0) {  
    Logger.log('WARNING: Somehow the denominator in the Z-Score calculator was 0.');
```

```
    return -1;
```

```
  }
```

```
  return ((c.cr-t.cr)/Math.sqrt(Math.pow(c.se,2)+Math.pow(t.se,2)));  
}
```

```
//From: http://www.codeproject.com/Articles/408214/Excel-Function-NORMSDIST-z
```

```
function normSDist(z) {
```

```
  var sign = 1.0;  
  if (z < 0) { sign = -1; }  
  return round(0.5 * (1.0 + sign * erf(Math.abs(z)/Math.sqrt(2))));  
}
```

```
// From: http://picomath.org/javascript/erf.js.html
```

```
function erf(x) {
```

```
  // constants
```

```
  var a1 = 0.254829592;
```

```
  var a2 = -0.284496736;
```

```
  var a3 = 1.421413741;
```

```
  var a4 = -1.453152027;
```

```
  var a5 = 1.061405429;
```

```
  var p = 0.3275911;
```

```
  // Save the sign of x
```

```
  var sign = 1;
```

```
  if (x < 0) {
```

```
    sign = -1;
```

```
  }
```

```
  x = Math.abs(x);
```

```
  // A&S formula 7.1.26
```

```
var t = 1.0/(1.0 + p*x);
var y = 1.0 - (((((a5*t + a4)*t) + a3)*t + a2)*t + a1)*t*Math.exp(-x*x);

return sign*y;
}
}

function getAdWordsFormattedDate(d, format){
  var date = new Date();
  date.setDate(date.getDate() - d);
  return Utilities.formatDate(date,AdWordsApp.currentAccount().getTimeZone(),format);
}
```